THE SURGICAL CLINICS
OF
NORTH AMERICA

Volume 10 Number 4

CLINIC OF DR. W. D. HAGGARD

Vanderbilt University and St. Thomas Hospitals

INTRATHORACIC GOITER

This patient, S. K., who is having novocaine infiltration of her goiter, is fifty-seven; entered the hospital on March 26, 1930 complaining of a mass in the neck which caused shortness of breath. About twenty-three years ago, at the age of thirty-four, she first noticed a slight enlargement in the region of the thyroid. This mass has slowly but steadily grown larger since. It has never given any symptoms until about three months previous to admission. At that time the patient began to notice considerable obstruction to breathing. She has been unable to stoop without dyspnea, and on exertion experiences difficult breathing. During the past few months there has been marked loss of weight, about 44 pounds. She has grown progressively weaker and becomes short of breath on the slightest exertion. There has been no evidence of thyrotoxicosis such as nervousness or palpitation. She has not noticed any change in the condition of her eyes.

Past history is negative, the patient having never suffered any serious illnesses. She had two normal pregnancies and one miscarriage at seven months. No significant findings in the family history.

Physical examination shows no apparent respiratory distress although there is some stridor. The voice is somewhat shrill and there is no cough. The skin is somewhat scaly but warm. The head is normal in shape and contour. There is bulging of the eyeballs and some lagging of both lids on looking up or down. Pupils react normally. There is no nystagmus but slight arcus senilis. The fundi are normal. Nose and ears are negative. Mouth shows many carious teeth and pyorrhea of gums. The tonsils are somewhat enlarged, but not infected. The vocal cords are asymmetrically placed, the right being somewhat relaxed but adducts and abducts normally. The impression is that the deformity of the right vocal cord is caused by pressure from the outside and not any affection of the recurrent laryngeals. The appearance of the neck is quite remarkable. There is marked enlargement of both lateral regions of the anterior part of the neck. The enlargement is irregular, nontender, and gives the impression of being solid. There is involvement of all the lobes of the thyroid. The left cervical glands are quite hard and movable. Situated anterior to the enlargement on the right is a stony hard mass about the size of a walnut which is movable on the thyroid. The tumor as a whole is immovable and gives

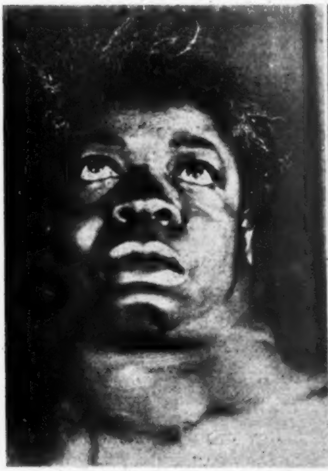


Fig. 279.—Bilateral and right intrathoracic goiter showing varices on chest.

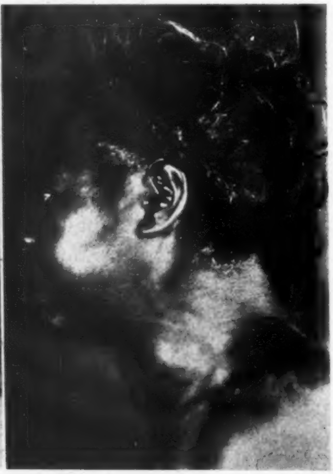


Fig. 280.—Goiter—lateral view of Fig. 279.

the impression of extending below the manubrium. The lower border of the tumor on the right cannot be felt above the clavicle even in the ascending part of the act of swallowing. Examination of the chest shows large tortuous varicose veins on the right anterior chest wall extending down into the axillary region. The breasts are senile and negative. Examination of the lungs shows evidence of slight atelectasis at the bases. No other significant findings. The retromanubrial dulness is somewhat widened.

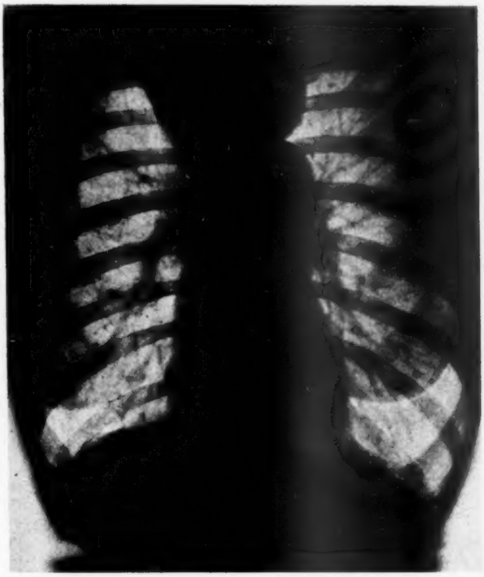


Fig. 281.—*x*-Ray showing intrathoracic goiter extending to arch of aorta.

The heart is slightly irregular in its rhythm, which irregularity seems to be due to an occasional extra systole. The size of the heart is not remarkable. No murmurs heard. The radial artery is slightly thickened. The abdomen shows nothing of significance. Pelvic examination negative. Extremities show no edema. Reflexes are present and active.

The basal metabolic rate was −19. Temperature, pulse rate, and respiration on admission were normal and remained so until operation.

Red blood count was 4,020,000; white blood count 4600; hemoglobin 70. Differential count normal. Wassermann was positive in both antigens and the Kahn was also positive. The urine was negative.

x-Ray of the chest showed a shadow extending down from the level of the neck into the thorax and overlapping the shadow of the arch of the aorta. This was taken to be the intrathoracic portion of the goiter. The cervical lymph nodes around the mass in the neck showed calcification in the *x*-ray. *x*-Ray of the long bones showed no metastasis.

The patient is a rather poor operative risk, but operation is deemed necessary on account of the respiratory pressure symptoms which are gradually increasing. She has been digitalized for four days.

It is a multiple, nontoxic adenoma of the thyroid with large intrathoracic lobe (Fig. 281).

Local anesthesia has been completed and we will make this large median low collar incision and reflect the flaps widely. Hemostasis is very easily performed here in pleasing contrast to the exophthalmic cases. The sister muscles are separated at the midline and then on account of the very considerable size of these lobes we will have to cut the sternothyroid group between forceps in order to give us a trapdoor type entrance and wide exposure. We place the clamps high up above the loop of communication between the descendens noni and hypoglossal nerves so we will not interfere with the subsequent innervation of the muscles.

The right lobe is now deprived of its superficial fibrous or surgical capsule and the gauzy zone between this and the smooth peritoneal-like capsule of the gland gives us our line of cleavage for separating the external or so-called "surgical" capsule. Now that this is complete, we can control the superior thyroid by three clamps, cut between and liberate the pole leaving two clamps on the superior thyroid artery. If we proceed to outline the incision across the gland from within out by a cordon of forceps, we can do the same thing on the outer side after separating the lateral vein. This often bleeds as badly if it is not secured, as an artery. We will now cut across the right lobe from within out. You see I leave a fair margin of the posterior part of the adenomatous tissue over the blood vessels, nerve, and parathyroids. The inferior thyroid artery is secured high up on the outer sides between forceps. This avoids the recurrent laryngeal nerve. The outer aspect has been brushed smooth and clean from all tissues including any little specks that may be the parathyroid. We have a beautiful exposure and can resect the gland along the line made by the battery of forceps. A good many forceps you see, but that is the price of hemostasis. Hemorrhage is the main danger, injury of the recurrent laryngeal the thing to fear and sudden cardiac collapse some hours or days afterward, the only uncontrollable factor.

Now that the right lobe has been freed from above down, we must gently elevate the intrathoracic part using the mobilized gland above as a gentle tractor and with the fingers inserted around and beneath it, I am gradually peeling the condensed outer layer of structures from the smooth surface of the gland proper and in this way the tumor is being carefully eventrated through the superior strait of the thorax. As I elevate and push the tissues off we grasp the enveloping tissues with small forceps in order to prevent retraction and to prevent bleeding.

Now that the gland is out, we feel as much elated as one does after the head is born, and external rotation occurs. The intrathoracic portion is larger than a good-sized orange.

The left lobe, while larger than the right, offers no difficulty in its enucleation except the time-consuming care we have put in in application of this small Argonne Forest of forceps and then ligating them. We have done a good many of our goiters lately with the high-frequency radio-knife. The coagulation of the vessels held in each forceps is done by simply touching the forceps with the coagulator, the vessel is sealed up as if ligated. It only takes two or three seconds to each vessel; does away with ligatures entirely, and seems like a sleight-of-hand performance. We have now covered over the stumps on both sides and inserted a rubber tube and two soft drains into the intrathoracic cavity which is dry and has not bled and the usual closure is made with catgut and clips.

The patient is in good condition, but she will have a blood transfusion. She is type 2.[1]

Microscopical examination of the tumor showed it to be a colloid type of goiter.

Comment.—A considerable percentage of large goiters, perhaps 30 or 40, have some dipping behind the clavicle. We speak of these as substernal goiters. The larger the tumor and the longer its duration, the more likelihood of downward growth. About 5 per cent are intrathoracic and only 1 per cent are totally intrathoracic. Perhaps a few of these are aberrant thyroids, but the majority are sucked into the thorax from the lower pole with deglutition and the pressure of the superimposed muscles forcing it down into the superior strait of the open thorax. There it can grow unimpededly. They are nearly all adenomas with or without degeneration, but a certain proportion are toxic adenomas and give rise to the classical symptoms of hyperthyroidism. In some cases the presenting lobe in the neck has been removed and the intrathoracic part overlooked and left behind. Perhaps if it had occurred to us we would have felt like classifying it as an aberrant type of development, with no connection between the two.

This tumor, as shown by the *x*-ray, rested on the arch of the aorta and it was more or less intimately connected with the pneumogastric and recurrent laryngeal nerve going alongside of the trachea in close connection with the phrenic and sympathetic and bounded on the inner side by the common carotid, on the outer side by the parietal pleura, and on the mesial side by the esophagus as well as the trachea. Fortunately, by keeping close to the capsule, we elevated it from all of these structures and left them *in situ*, apparently without accident. We were aided too, as you noticed, in elevating this tumor, by asking the patient to cough. It did not extrude the goiter as is sometimes done in the so-called "plunging" type. These are not completely intrathoracic. You noticed that the coughing gave some elevation. Occasionally one will be coughed literally up out of the thorax.

---

[1] Following operation the patient ran a maximum elevation of temperature of 102 F. and an elevation of pulse rate to 120, but they returned to normal in a few days. Drainage of a serosanguineous material has continued since operation but has practically cleared up. She was discharged from the hospital at the end of two weeks. There is still some induration at the site of the lateral lobe of the thyroid. This, however, is gradually diminishing. The large varicose veins over the right front of the chest have all disappeared.

The trachea in this case was pressed on considerably so that she could not get sufficient air and in some cases it is so extreme that it is a mere slit in the trachea and it assumes the shape of a scabbard. It may be flexed rather markedly to the opposite side from pressure. I call your attention to the large vessels on the front of her chest and in the right axilla indicating the compensatory circulation to overcome the circulatory interference.

While she had a sort of "tin-pan" voice, it apparently was more from pressure on the trachea than paresis of the recurrent laryngeal nerve as there was no change in the arytenoids laryngoscopically.

Some of these patients have suffocation that almost amounts to asthma and at times it comes on even while they are sleeping. Some cases are obliged to sit up in a rocking chair like a cardiac case. Lahey has called attention to the fact that when a goiter on one side presses on the trachea they cannot lie sideways on a pillow as elevation of the head increases the pressure. The patient will commonly notice and tell you of this. It is a symptom of importance and should be inquired about.

In very large tumors, the upper portion can be felt through the pharynx; palpation at the sternal notch will detect the elevation and depression of the substernal variety, as the patient swallows. Dysphasia is sometimes severe.

The question may well be asked: what does it profit a patient to allow a small growth in the neck by delay to become an intrathoracic goiter while she is oblivious to this difficult and dangerous complication that is overtaking her?

PERFORATED DUODENAL ULCER

THIS man, fifty-two years of age, is convalescing from operation a week ago. He was suddenly seized with extremely severe epigastric pain, so excruciating that he staggered into Dr. Farrar's office and had ½ grain of morphine administered at once. At that time and afterward, the upper abdomen had a boardlike rigidity. There was no vomiting until after the injection of morphine. When he came to the hospital seven and a half hours afterward he had vomited twelve times, mostly greenish bile. The pain was not severe, the temperature was normal, pulse 80, leukocytosis 18,800. There was some tenderness in the right iliac fossa.

The previous history was that as a young man he had had continued fever for six weeks without chills. That he had had three attacks of upper abdominal colic seven and a half, four, and three and a half years ago respectively. They were afebrile, did not require morphine, and lasted only two or three days. He had had stomach trouble for several years characterized by food ease and the return of pain about two hours after food. He had never vomited blood and in fact nothing whatever and had never had any night pain. This stomach trouble had been in existence during periods for several years, but had been rather continuous for two weeks prior to his admission.

It was obvious that he had an upper abdominal lesion. The typhoid history, the three previous attacks of pain rather pointed to the gallbladder as did some slight reference of the pain to the lower right thorax posteriorly at this time; as against the gallbladder was his high leukocytosis in such a short time.

The tenderness over the appendix was interpreted as fluid that had escaped from the perforated duodenal ulcer which diagnosis had been made by his physician when the patient was first seen. It is well known that the fluid coming down over the hillock of the transverse colon localizing around the appendix is often mistaken for appendicitis. Weir found that 50 per cent were mistaken for appendicitis. While he was tender over the appendix, there was no rigidity there.

A right upper rectus incision, under gas supplemented by local anesthesia, showed thick, light, gray exudate around the gallbladder and duodenum and upon raising the duodenum up, the typical foamy appearance of the escaping fluid gave the telltale diagnosis of perforated duodenal ulcer, which was closed with four interrupted silk sutures supplemented by a small portion of omentum tacked over the sutured area. There was a considerable quantity (12 or 14 ounces) of yellowish fluid which gravitated in the pelvis after a 60-mile ride in an automobile and for the relief of this a rubber tube and two Penrose drains were inserted through a stab wound suprapubically. The bed was put in extreme Clark's position, hypodermoclysis, transfusion, and proctoclysis kept up and morphine administered every four hours. On the second day, a Hendon cannula was inserted into the median basilic vein and a continuous venoclysis of 10 per cent glucose in normal salt solution to the amount of approximately 4000 cc. was given each twenty-four hours, for three days. It afforded him 480 Gm. of glucose daily and nourished him adequately. He took absolutely nothing by mouth for three days—had no desire for food. It allowed the perforation to heal firmly and is one of the most useful adjuncts in the treatment of desperate surgical and other conditions.

My associate, Dr. W. O. Floyd, recently made a diagnosis of perforation of a duodenal ulcer over the telephone and urged operation in a case in which the attending physician had made a diagnosis of gallstones because the pain had been referred to the back. He ignored the history of the case when for some months before the man had epigastric pain at 10 o'clock and 4 o'clock in the afternoon, at which time it was thought to be ulcer, but the man declined further examination and operation, and improved under treatment for six weeks.

While at lunch after a morning's hard work he was suddenly seized with severe, knifelike, excruciating pain in the pit of the stomach, followed later by vomiting. The pain was so severe the man could neither lie down nor sit up; upon arrival of the physician, at the end of three quarters of an hour, it required three doses of morphine to relieve his suffering. On account of the boardlike rigidity and the inordinate amount of morphine required Dr. Floyd insisted the man did not have gallstones, but most probably a perforated duodenal ulcer, which he confirmed by operation at the end of forty-eight hours. He cured the patient by simply draining a considerable quantity, probably a quart, of yellowish, watery, flocculent fluid which was walled off by adhesions and made no effort whatever to close the perforation for fear of general peritonitis as a result of breaking up adhesions.

Curiously enough, an uncle of the patient just spoken of was operated on by me fifteen years ago for perforating duodenal ulcer after eighteen hours, with recovery.

Comment.—It is estimated that about 12 per cent of gastric and duodenal ulcers are complicated by acute perforation. In 496 cases occurring in the United States Army in four years, the incidence was 8.87 per cent. Peculiarly enough, Troutt found among soldiers in the American Army in Hawaii that 33.3 per cent of ulcers perforated. He attributed that to the changed environment, homesickness, mental depression, smoking, and the use of impure alcoholic beverages.

Perforation occurs more frequently in men than in women. Of course men have it more, but I mean in reference to the actual relationship more occur in men than in women. It occurs too during the ages of active life from twenty-five to forty-five. It usually happens when the stomach is full and we assume the erosion has advanced almost to the peritoneum and perforation follows as a result of some strain. It has been known to occur during sleep.

The question of whether or not gastro-enterostomy should be done at the time of perforation depends largely upon the period that has elapsed after the perforation. In early cases where peritonitis has not developed, it is good surgery to do a gastro-enterostomy because it not only gives a good opportunity for permanent cure, but it helps so in preventing leakage and does not materially increase the risk. However, after more than eight hours have elapsed and when peritonitis is present, the paramount indication is to treat the peritonitis, close the opening to prevent leakage, and save the patient.

Of course next to the immediate saving of the patient from the threatening peritonitis, is the prevention of duodenal leakage. It has been shown that if all of the pancreatic, biliary, and duodenal contents are discharged through a fistula in an animal that it will not live but a week. It seems that the pancreatic juice is essential to life and when that erodes a large area on the skin, the condition is very serious. We have obviated that in part in high intestinal fistula by large compresses of cotton held firmly by adhesive plaster, physically damming back the material, and have brought about healing in that way. The method recently described by Potter consisting of neutralizing the alkaline pancreatic and biliary juices with one-tenth normal hydrochloric acid; suction drainage of the wound every two hours; drying with alcohol; dressing with one-tenth normal hydrochloric acid; the use of Witte's peptones for combination with the unalkaline juices, is also very useful and should be employed in cases of duodenal fistula.

After spontaneous perforation and the patient has been rescued by a simple closure of the ulcer a great majority of them are permanently cured. In fact, when the area is inspected again, for instance after the closure of an incisional hernia, the area has been found to be entirely healed without stenosis.

McGlannan found as a result of operation upon 28 patients for perforated ulcer that 9 patients died, 6 of them from peritonitis, usually from the long delay. He found that 10 out of 13 patients made a perfectly satisfactory recovery and that only 2 required any further operative procedure.

In our first hundred cases of operation for duodenal ulcer, 22 per cent were for perforation. In our last 40, there have been 6 perforations, about 15 per cent, 4 recovered and 2 died.

Four had a subacute condition. In 3 of these cases the perforation was closed and a gastro-enterostomy was done. All 3 of these cases recovered. The fourth subacute perforation had the omentum sutured over the perforation in addition to a closure and was closed without drainage. This case died four days later. The other 2 were acute, 1 of them having a general peritonitis at the end of a twelve-hour perforation, which was closed and drainage was instituted because of the great amount of contamination. This case died three days later from a general peritonitis. Thus we had four recoveries in six operations for perforated duodenal ulcer. This is about true to form, as the average mortality is 33.3 per cent.

CECOSTOMY FOR COMPLETE OBSTRUCTION IN RECURRING CARCINOMA OF THE DESCENDING COLON; MIKULICZ OPERATION; SECOND INTESTINAL OBSTRUCTION; ENTEROSTOMY; RECOVERY

This patient is most remarkable because she has sustained and recovered from two resections of the colon and two complete intestinal obstructions. She is fifty-eight years of age, had pain in the lower abdomen, during bowel movement, with bloody discharge for nearly two years, which was regarded and treated as internal piles, without examination. For several months the painful bowel movements were more severe, with increasing obstipation and melena. The pain was of a gripping character, and associated with occasional nausea and vomiting, and a loss of 25 pounds. There was a localized area of tenderness in the left side but no mass. A barium enema showed a typical filling defect.

Diagnosis of napkin-ring carcinoma of the descending colon was made with obstruction but no obstructive symptoms. At operation (June, 1929) under gas anesthesia, the mesenteric mass was small and extended practically to the parietal wall necessitating deep incision of the outer leaflet of the mesentery. No glands were palpated and no nodules in the liver were felt. The neoplasm was resected 5 inches above and below the constricting area with the Rankin aseptic clamp technic (Fig. 282). The left tube and ovary were adherent to the outer side of the growth, and were removed with the neoplastic mass. The bowel was completely covered with the peritoneum at the point of resection and the omentum tucked down over the suture line.

She was given a transfusion on or about the fifth day after operation and made a very satisfactory recovery.

At the end of about six months she began having difficulty and pain with the bowel action, requiring some diminution of her diet and mineral oil. A barium enema showed a narrow area which we took to be a stenosis at the anastomosis, but did not feel that it was malignant. She did not return for further observation until February 16th with a history of considerable cramplike abdominal pain and audible borborygmi, visible and painful peristalsis and considerable distention. She vomited twice and once in the bus on the way to the hospital. Her bowels had moved twice the day before. An enema brought only stained yellow fluid and little gas. Her pulse was 100, and she vomited 10 ounces of bile-tinged fluid. The colon was very considerably distended, tympanitic and tinkling sounds of obstructed gas were heard stethoscopically.

Diagnosis of intestinal obstruction was made and operation performed early the next morning. Obstruction had probably been complete for nearly forty-eight hours. A cecostomy was made under local anesthesia. Intra-abdominal examination showed no metastasis to the liver; the site of the former resection presented a hard nodular mass about the size of a crabapple, stenosing, adherent, the lower segment quite empty and taut. Above the obstruction there was enormous distention of the entire colon and the caput was as large as a grapefruit. There was visible, audible, and painful peristalsis before operation. The colon was as large as one's arm. During the elevation of the cecum, it was ruptured but rapidly withdrawn so that no actual peritoneal soiling occurred and a large tube put in the opening. She made a very satisfactory recovery from the complete obstruction.

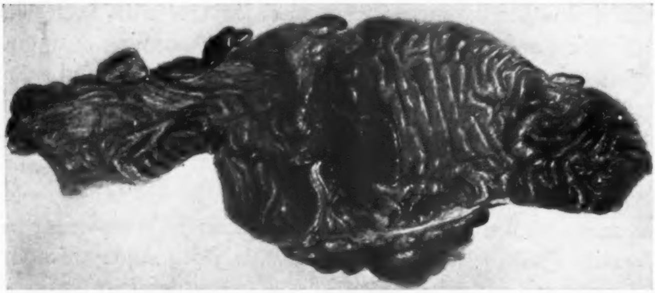


Fig. 282.—Napkin-ring carcinoma sigmoid after resection.

Three weeks after that, under spinal anesthesia, the growth was with great difficulty elevated through a left lateral incision as a first step in a Mikulicz. The lesion was bound down tightly to the lumbar muscle and separated with great difficulty. The iliac artery was seen, isolated and the left ureter separated from underneath the growth and drawn with tape to the inner side to prevent injury and to allow eventration of the growth. On account of the tautness resulting from the previous resection this was very difficult. It was only accomplished by making a good many efforts at division of a considerable part of the mesentery, holding the colon, not without some anxiety about interfering with the mesenteric blood supply. She had some shock and was given a transfusion after the operation and made a satisfactory recovery. Three days afterward the colon was opened and irrigation and drainage of fecal matter occurred both from the cecostomy tube and the new colostomy opening. On the sixth day after the colostomy the patient had abdominal pain with vomiting, no temperature, and an absence of feces from the colon tube for a day and night. It was apparent that she had obstruction of the small intestine. When not a drop of fecal drainage or discoloration came from the colon on repeated irrigation any tyro could have diagnosed obstruction. Ileostomy was done under local anesthesia in bed in the midline below the umbilicus and a catheter introduced into the large distended loop of the ileum. There was some free fluid.

About 3 pints of liquid fecal fluid were drained from the distended ileum. Fifty-four ounces drained out the first night and 49 ounces the next day. On the fourth day, she was given a prophylactic tranfusion and the following day she was given venoclysis of 10 per cent glucose solution by the Hendon cannula tied into the vein and allowed to remain for four days. During this time she was given about 4800 cc. of normal salt solution for twenty-four hours, containing about a pound of dextrose which was very nourishing and allowed us to stop all feeding by mouth and the ileostomy closed shortly after the removal of the tube as a result of this absence of food and nourishment by venoclysis.

At the end of two weeks, the excluded colon with tumor was removed with a high-frequency radio-knife and the blood vessels occluded by the coagulation method.

It only remains to do the third stage of the Mikulicz and close the skin over the sigmoid. As a result of the tension upon the two loops there was some sloughing of the upper limb which did away with the usual spur between the two loops, rendering the second stage of the Mikulicz unnecessary.

ENTEROGENOUS CYST OF ILEUM CAUSING OBSTRUCTION IN AN INFANT

THIS postmortem specimen is from a three-week-old baby which my associate, Dr. C. R. Crutchfield, removed recently. She weighed 9 pounds, 5 ounces at birth, was delivered normally here in the hospital, only child, healthy parents. When one week old had lost 15 ounces. At end of another week had gained 4 ounces. Five days later weighed 8 pounds, 8½ ounces. The 1½-ounce loss in last five days was attributed to the mother's giving very little milk. The baby spit up an increasing amount of milk after each nursing, and was put on supplemental lactic acid milk by Dr. O. H. Wilson, but more and more curdled milk and bile were spit up after nursing. There was some distention of the abdomen and visible peristalsis. There was constipation, but the enemata were highly colored. The next twenty-four hours the baby continued to vomit practically all of the milk, visible peristalsis was more marked and a smooth, round, movable tumor the size of a hen's egg palpated just to the right and slightly above the umbilicus. Enemata returned clear. Rectal examination was negative. There was no blood in the stools, no temperature.

There we had an apparently healthy baby three weeks of age with increasing vomiting for three days of bile-stained, curdled milk. The enemata returned highly colored until the past twelve hours. Blood and urine normal. The tumor was too large and too low for hypertrophic pyloric stenosis. The vomiting coming on thirty-five to sixty minutes after nursing and not of projectile type was also against it. The temperature and leukocyte count being normal and the tumor very smooth and not tender and freely movable, together with the absence of bloody stools, was inconsistent with intussusception. Intestinal obstruction of seventy-four hours' duration, due to the tumor, was obvious.

Under novocaine a bluish-gray colored, rounded, cystic tumor, the size of a hen's egg was delivered. It was on the ileum

1 inch above the ileocecal valve. The intestine below was somewhat collapsed and the intestine above was distended. The tumor was intimately connected with the intestine and a part of it.

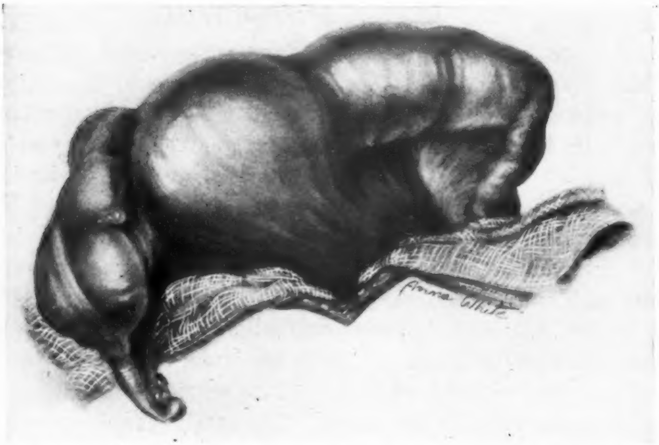


Fig. 283.—Developmental enterogenous cyst of ileum, causing obstruction in an infant.

The tumor apparently originated in a hard fibrous area at the mesenteric attachment and extended up beneath serosa and mucosa, collapsing the intestine with its internal pressure as it

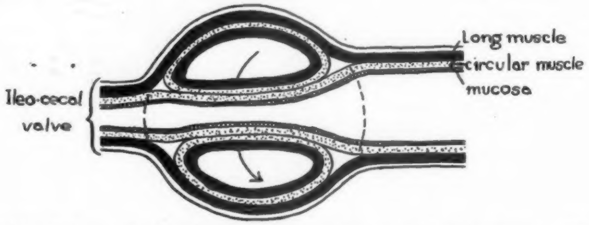


Fig. 284.—Schematic drawing of the cyst almost encircling ileum. Wall of smooth muscle. No mucosa cells lining cyst.

grew and produced complete intestinal obstruction. The tumor was fluctuant. Aspiration revealed thick, tenacious, grayish colored mucus without odor. Culture and smear were negative.

The tumor was opened and contents evacuated extraperitoneally after packing off. Cyst wall 2 mm. thick and sac did not communicate with the lumen of the intestine, but the thickness of sac wall extended entirely around the intestine. Excess of sac wall removed, leaving cyst sac wide open. The thick, circular fibers of sac wall were incised down to the mucous membrane of the intestine, as in a Ramstedt. The contents of distended bowel were seen and felt to pass into collapsed intestine below. There still remained a partial constriction of the intestine, but the lumen was adequate. The remains of the cyst sac were sutured and fixed to the lower angle of the wound to facilitate enterostomy subsequently, if necessary. One hundred and eighty-five cc. of father's blood was citrated and introduced into the superior longitudinal sinus. Condition satisfactory.

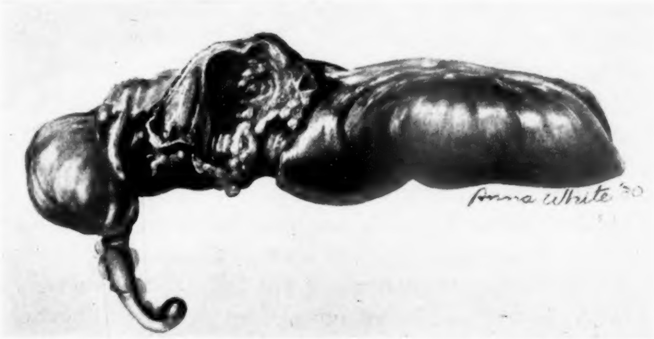


Fig. 285.—Postmortem specimen of enterogenous cyst of ileum showing cavity of cyst which had been opened by decompression and edge sewn to peritoneum of incision to facilitate enterostomy, if necessary.

Pathologic diagnosis: Smooth muscle cyst wall.

On the third day enemata expelled with gas and fecal matter. Obstruction seems to have been relieved, but the baby died at the end of the third day of pneumonia secondary to peritonitis.

The autopsy specimen is depicted in Fig. 285.

Comment.—This case belongs to the group more often called "ileocecal cysts" and is a developmental enterogenous cyst.

Evans[1] in reporting his case, clearly demonstrates the relationship between developmental enterogenous cysts and diverticula. He states that "all cysts found in the abdomen, or in the thorax, or at the umbilicus, having the structure of the gut, must have been derived from the primitive intestinal tract," and that these developmental enterogenous cysts originate either in the vitello-intestinal tract, or in the diverticula which are found in the developing entoderm of the embryo as described by Keibel and by Lewis and Thyng. Instances are given of enterogenous cysts which originated in developmental diverticula situated in the segments of the primitive intestinal tract which later became esophagus, stomach, duodenum, jejunum, ileum, ileocecal region, vermiform appendix, or sigmoid; also of enterogenous cysts which originated in some unobliterated portion of the vitello-intestinal tract."

Jackson[2] reported a similar case in a girl six years of age, occurring in the mesentery of the transverse mesocolon and attributed its development to a remnant of the omphalomesenteric duct or from a misplaced portion of the intestine.

Frankel (quoted by Evans) had an identical case, a three-day-old female, in which the cyst was between the muscular layers of the gut producing obstruction and was found to contain muscle fibers only in cyst wall. Case summarized: "Intestinal obstruction; fecal vomiting; energetically purged; death."

Slesinger[3] reported a case in a boy aged seven which was located 8 feet from the ileocecal valve. He did an end-to-end anastomosis after excising the cyst with the attached gut and the boy made an uneventful recovery. Theoretically that would have been the best procedure in our case, but the child was too young for resection. It was also thought that possibly if the tumor had been delivered and the peritoneum sutured to the gut and the tumor subsequently excised, leaving the cut ends of the gut to drain on the abdomen (Mikulicz) would have been better. This has been done for other conditions in the newborn, but they rapidly lost weight because of insufficient absorbing surface since the colon was eliminated and a subsequent anastomosis would be attended with a very high mortality. These cases are interesting, but fortunately rare and each is a problem in itself.

---

[1] Evans, Arthur: Brit. Jour. Surg., vol. xvii, 15, July, 1929.

[2] Jackson, J. A., and Ewell, G. H.: Enteric Cysts; A Case Report, Wisconsin Med. Jour., 28, 118, 1929.

[3] Slesinger, E. G.: Brit. Jour. Surg., 16, p. 333, December 28th.

SKIN GRAFTING FOR COMPLETE AVULSION OF THE SCALP

This picture (Fig. 286) shows the uncompleted result in a woman, aged fifty, who was brought to St. Thomas Hospital six hours after having her entire scalp torn from her head while bending over an electric pump, her hair having become entangled in a revolving shaft. Following the injury, the patient walked into the house, looked in a mirror, and saw that she had no hair. She had bled profusely from the denuded area, but not enough to shock her. The doctor came and bandaged her head. The entire scalp was found in the yard adjacent to the pump where

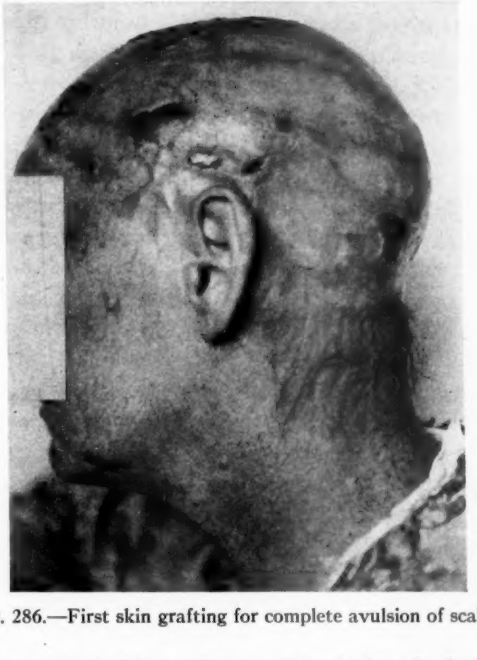


Fig. 286.—First skin grafting for complete avulsion of scalp.

it had been tossed through an open window. The scalp with hair attached was brought to the hospital.

Patient was not complaining, not shocked, and apparently none the worse after her unusual accident and a 150-mile drive. There was a complete avulsion of the entire scalp from the edge of her eyebrows to the nape of her neck. There was a small fringe of hair remaining on her neck posteriorly and a small patch of hair below either temple of scalp.

Under gas anesthesia the head was cleansed with green soap, ether, and salt solution, a few bleeding vessels were ligated and a vaseline dressing was applied. Believing that it would not live, but at the urgent suggestion of consultants, the scalp having been preserved, an effort was made to utilize it as it was intact and seemed a perfect and natural covering. Shaven free of hair, and all débris and adherent tissues removed, it was preserved in warm normal saline solution for a few hours, was sutured *in situ* after thoroughly cleansing the field with ether, green soap, and boric acid. Multiple through-and-through incisions of the scalp were made to allow the escape of pent up fluids, eight stay sutures of silkworm were used to prevent the scalp from slipping, and a moist boric acid dressing was tightly applied.

Forty-eight hours later the scalp was malodorous, dark in areas, and patient toxic, with a temperature of 104 F. Scalp was removed as there was beginning gangrene with a darkened area of periosteum along the frontoparietal suture, especially at junction of parietal with occipital bone. This area was cleansed with green soap and ether and a moist dressing of bichloride applied.

Under gas anesthesia on September 14, 1928, one week later, long Thiersch grafts were cut from the posterior surface of each thigh and applied to the healthy granulating surface on the left lateral and posterior portions of the scalp. Two lateral areas each 2½ by 3½ inches, on either side near the vertex, which were denuded of periosteum at the time of avulsion and were white, pale, and dark in center, were drilled with multiple holes until drillings were pink or blood tinged. The grafted area was left open save for denuded periosteum, which was covered with vaseline gauze and collodion.

A second skin graft was made forty days later to the right side of her head, the first graft having taken well. Thiersch grafts taken from posterior and anterior surfaces of the thighs were placed over remaining healthy granulating tissue on the right third of her head (scalp) and granulations that had come up through the drill holes of operation six weeks before. One small area 2 x 3 inches which was devoid of periosteum or granulations, was redrilled with eight or ten holes again. No dressings were applied and the grafts were left open to the air. The grafts took well except in the region of the right parietal region. Temperature of 101 F. daily persisted for some weeks and later a large piece of thin bone 6 x 14 cm. was separated with multiple drill holes perforating it. It was the outer table of the bone deprived of periosteum and had been in its desquamation the cause of the temperature which had been otherwise unexplained and stopped abruptly.

About two and a half months thereafter, this denuded area in the right tempoparietal region was grafted with large Thiersch grafts and pinch grafts to several small areas.

Eight weeks later the entire scalp was covered with thin pink skin except an area $1\frac{1}{2}$ by 14 cm. on the right tempoparietal region which was covered with 80 pinch grafts. The entire head is now covered with healthy skin. She wears a becoming wig made from the hair taken from her avulsed scalp.

Scalping was practiced among the Asiatics, Europeans, and Africans as well as the American Indians. Indeed, the amount of scalps taken varied with the respective tribes. Scalping is mentioned in Deuteronomy XXXII : 4 and also in Maccabees II-VII : 7.

Cleavage usually takes place in the loose areolar (subaponeurotic) layer though the periosteum is also sometimes removed. The occipitofrontalis and temporal muscles are more or less lacerated. Practically all scalped victims died from hemorrhage. Bevings found in the Philadelphia Medical and Physical Journal the report of an avulsion of the scalp in 1777. Dr. Vance bored multiple openings in the outer table of the skull to the diploe with a shoemaker's awl and ceased boring "when a reddish fluid appeared on the point of the awl." "Proud flesh" appeared to rise in these holes, but Vance observed "it skins over remarkably slow." He advised that these holes be bored when, as and if the bone turned black. Mellish observed in the reported cases that avulsion of the scalp was often attended with fatal hemorrhage. Then too the danger from infection is not inconsiderable. A mortality of 8 per cent is reported. Up to 1924, a total of 173 cases of avulsion of the scalp had been reported. The first case of avulsion due to machinery was that of Downs, in 1838.

In 40 cases of the above series, attempts were made, unsuccessfully, to replace the scalp and make it grow. With partial avulsion of the scalp where there remains substantial attachment, the scalp that is drawn back as a hood can be sutured in place with success, but in the case of complete evulsion it is futile to attempt it as the scalp is too thick for the reestablishment of circulation and only receives nourishment around its sutured periphery.

Metolitzki first employed skin grafts in the treatment of avulsion cases in 1869. Bartlett (1871) was the first in the United States to use autodermic Reverdin grafts in the treatment of complete denudation of the cranium. The large strips of epidermis were not employed until the next year by Ollier of Lyons and perfected by Thiersch of Leipzig in 1874. Prior to this epochal work, the healing over of an avulsed scalp required an interminable period, cicatrization occurring only after years of suppuration, if at all. Syme's patient had suppurating points eight years after the accident.

Socin (1889) first employed Thiersch grafts in a scalped case.

It has been proved that skin strips live even as long as forty-eight hours. Thiersch grafts from an avulsed scalp if gotten within twenty-four hours may be tried in appropriate cases. Even though we recognize the utter hopelessness of making a completely avulsed scalp grow, the scalp can be shaven, saving the hair for a transformation.

There are only two types of skin grafting that are thoroughly applicable to the treatment of such cases, namely, Thiersch-Ollier grafts and Reverdin, minute plugs of full thickness skin, or the modified small deep pinch grafts. Abbe of New York planted 12,000 grafts over a period of four years in one case. There seems to be more likelihood of contraction with Reverdin grafts than with Thiersch grafts. The grafted head presents a very thin, shiny skin in which the blood vessels are plainly seen. Sensation comes in from the periphery so the greater part of the grafted area may remain anesthetic for years. This may also explain the tendency to minute ulcerations.

CLINIC OF DR. C. JEFF MILLER

FROM THE DEPARTMENT OF GYNECOLOGY, TULANE UNIVERSITY SCHOOL OF MEDICINE, AND THE CHARITY HOSPITAL, NEW ORLEANS

RADIUM AS A TEMPORARY HEMOSTATIC MEASURE IN A LARGE UTERINE FIBROID

THIS patient is a colored female, aged forty-two, of very limited intelligence. From her history, however, we gather enough for our purposes: She had one full-term, normal labor twenty-six years ago, and until her present illness her menstrual cycle was normal in every respect. Since January 1st of this year, which was the onset of her regular menstrual period, she has had a profuse, practically continuous uterine bleeding, which has been increasing in amount and duration. Recently she has been confined to bed. She thinks she has lost about 60 pounds, though her present weight is 250. She does not know how long she has had a mass in her abdomen, but thinks for many years. Aside from the bleeding, frequency of urination is her chief complaint. We see that the abdominal mass is large, hard, and irregular, and pelvic examination shows us that it is the size of a seven or eight months' pregnancy. Blood examination shows only 2,230,000 red cells, and a hemoglobin of 30 per cent.

This woman has, as you see, multiple fibroids of the uterus, and ordinarily we should do a prompt hysterectomy. But we cannot do that in this instance. In the first place, there is a blood picture far below normal. The patient has been bleeding profusely over a long period of time, and she is not a good risk for a serious operation. And operation would be serious in her case, under any circumstances, because she is extremely stout, she has a deep pelvis, and she has a large, probably impacted growth. Ordinarily such a patient would be put to bed and built up for operation by the accepted methods, but this woman, for economic reasons, must not lose any more time than she can possibly help. Her livelihood depends upon her own exertions, therefore expediency must guide us to some extent.

We are going to break our usual rules in regard to the application of radium in large growths and give this woman an exposure of 2400 mg. hours. This is a safe procedure for her, we think. We are quite sure, from her previous history, from the absence of any complaint of pain, and from the pelvic examination that, unlike so many of her sisters, she has no pelvic infection. If she had, regardless of her circumstances or her condition, we should have to devise some other method of treatment. Radium is a very dangerous agent in the presence of pelvic infection, and if you use it lightly you are going to regret it.

Then we can safely ignore this woman's anemia, profound as it is, because we know its cause. She has bled long enough and in amounts large enough to explain it perfectly. But if the reverse were true, if she had bled only a little and had appeared with this degree of anemia, again we should not have been able to use radium, for we should suspect that some degenerative changes were going on within the growth, and the possibilities of infection, in such instances, are very great.

This woman, because of her obesity, will never be a good surgical risk, and it would be an ideal thing if we could treat her altogether by radium. But that is out of the question. This tumor may surprise us and disappear altogether under the treatment we are instituting, but that is a most unlikely outcome. Tumors larger than a three or three and a half months' pregnancy, while they may diminish in size, will not disappear under irradiation. Even if this growth is reduced by half its present size it will still be large enough to annoy the patient. She is having bladder symptoms now, frequency and urgency, which are due to pressure and which will not be influenced by irradiation. Our treatment is directed to only one end, to check the hemorrhage and permit the patient to regain her strength to such a degree that surgery will carry a lower risk for her.

She is being given a light gas anesthesia because it is not safe to make an application of radium without knowing what is in the cavity of the uterus. If there is a polypus or a submucous growth, and it is not cleared out of the way, we shall simply be exchanging a bad condition for a worse one. You can well understand how a sloughing process might initiate a very serious infection. For infected fibroids are serious matters. They mean weeks or months of fever, and they contraindicate surgical interference until the infection has subsided. We have recently lost a patient on this service in whom surgery was contraindicated for this reason from the time of her admission. We were never able to do anything for her.

Again, there may be a malignancy of the fundus, and if there is, radium is not the proper treatment. The only way we are going to find these things out is by routine diagnostic curettage, and do not let anybody persuade you to apply radium without it.

This patient, on examination, shows a slight laceration of the cervix, well healed and apparently uninfected. There is therefore no reason for a biopsy. She has a marked relaxation of the perineum and a marked cystocele, but this is no time to deal with her obstetrical injuries. The sound shows us that the uterine cavity is at least 2 inches longer than normal. Dilatation is done with the graduated Hegar dilators, whose force we can gauge, as we cannot gauge the force of the glove-stretcher type of dilator. That is another instrument which has no excuse for being. You can rupture the cervix with it before you realize what you have done.

We are now curetting the uterus thoroughly, sweeping the curet in all directions, being careful to reach every area of the cavity, in order not to overlook polypi and small growths. We have removed a considerable amount of débris, and even though the scrapings are not grossly malignant, they will be examined in the laboratory to eliminate this point definitely. Never overlook this precaution. You have achieved nothing by a curettage of this sort if the pathologist does not pass upon the material. Next the cavity is wiped out carefully with a sponge forceps and sponge, this being a safer method than the irrigation which was formerly practised routinely.

Finally the radium is applied well to the top of the fundus and screened with brass and rubber. We put a large pack in behind it, to be certain that it cannot slip out under the stress of movement, vomiting or uterine contractions.

We cannot expect to secure the effect of the radium immediately. The patient, if what we have done for her this morning checks the bleeding, as we expect and hope it will, will have at least one more period, perhaps rather a profuse one. Then we can look for results. At any rate, we shall not repeat the dosage for at least ten weeks, and in 95 per cent of all patients it is not necessary to repeat it at all. Our further course with this woman will depend upon the condition we find her in when she returns in three months for examination. We have little doubt that the size of her growth will demand surgery, and we shall undertake it then if her general condition has improved to the extent that we consider her a reasonably safe risk.

THROMBOPHLEBITIS OF BOTH LEGS, FOLLOWING MANUAL REMOVAL OF THE PLACENTA

THIS patient has been sent down to us this morning from the rest ward, to which she was admitted March 4th, with a complaint of pain and swelling in both legs. She is a white woman, para 9, aged thirty-four. Twenty-two days before admission, she tells us, she was delivered spontaneously of a full-term child by a midwife. Immediately after the delivery the attendant made traction on the cord to extract the placenta, which separated under her efforts, and a portion was left within the uterine cavity. This the midwife attempted to remove manually. The patient lost a great deal of blood at the time, within an hour she had a severe chill, which has been succeeded by several others, and there has been a persistent bloody discharge and a persistent low fever. The fifth day after delivery the right leg began to swell, although it was not painful, and two days before admission pain and swelling appeared in the left leg.

This patient has upset several rules. The fifth day after delivery is unusually early for a thrombophlebitis, as this condition is, to make its appearance. It seldom appears earlier than the eighth or the tenth day, unless there has been an extensive cervical tear or a rupture of the lower uterine segment, neither of which conditions is present in this instance. Again, for anatomical reasons, the left leg is usually the first to be involved, not the right as in this case.

The fact that this patient has a thrombophlebitis means that she has had an infection, though it does not mean that she has had a stormy puerperal course. She has had occasional chills, but her temperature has not been over 101 F. and it is just 100 F. now. But do not lose sight of the fact that in spite of this mild course there has been an infection, and it is the reason for it that I want to call to your attention particularly.

Bad management of the third stage of labor is just as important a consideration as bad management of the second stage.

The thing that is responsible for this patient's pathology is perfectly clear, and it is responsible for as many of the heartaches and as many of the tragedies of obstetrics as any single cause I can think of. As soon as this woman was delivered of her baby, intra-uterine manipulations were undertaken, and undertaken with ungloved hands. Her attendant probably never heard of gloves, and I am sure knew nothing of aseptic precautions. A physician, undertaking the same manipulations, would probably salve his conscience by the fact that he was wearing gloves and was surrounded by aseptic precautions, but there would be no more excuse for his performance than for that of this ignorant midwife. If anything, there would be less excuse.

There is not the slightest reason for interfering with the placenta immediately after labor. The separation of the placenta is a process which takes place by natural forces. It is a process which has been provided for exactly as the event of labor has been provided for, and if you are going to practise obstetrics, you had better make it your first rule to let the placenta take care of itself. I have seen a placenta remain *in situ* for many hours without harm to the patient. I have heard of an instance where it remained in place for three months, and for all I know to the contrary never separated later, though the woman suffered no inconvenience or ill effects. But, leaving aside these extreme instances, there is not the shadow of an excuse for attempting to remove a placenta immediately after delivery. You may cause a free hemorrhage, you may cause portions of the placenta to be separated within the uterine cavity, or you may find yourself with both accidents on your hands.

Again, intra-uterine manipulations within the parturient uterus are never anything but dangerous. I do not care whether you are in a hospital with every aseptic precaution possible, you are laying up trouble. Fully a quarter of the women so handled develop infections, and many of them lose their lives. The only reason for such interference is active hemorrhage which cannot be controlled by simpler measures such as uterine massage, packing and pituitrin. Do not invade the uterus until other remedies fail. We cannot control infection after it has occurred, therefore the wisest plan is to prevent its occurrence.

I did not subject this woman to vaginal examination, there was no special point to annoying her with it, for her trouble is plain. We shall not treat her by local measures, no matter what the pelvic condition may be. Some years ago she would have been curetted, perhaps several times, but we know now that nature takes care of infection better than doctors can, and we know that curettage only destroys the protective barrier of resistance which has been set up and which ought never to be disturbed. The curet has no place in the list of obstetrical instruments.

I do not know whether the piece of retained placenta is still in the uterine cavity. The chances are that it has been thrown off through natural processes, but if it is still present, I cannot see that we should be helping this woman by attempts to get it out. If it is still there, in the course of time there may be menstrual irregularities, indeed there probably will be anyway, for undoubtedly there is a subinvolution present. In the course of months a curettage may be indicated, but it is definitely not indicated now, and it may never be. In active infections, of which this case is an example, the best procedure is to let the patient alone, to build up her resistance by nourishment and rest, to aid her in the creation of her own immunity, but to keep out of her uterus.

I have trespassed on Dr. King's territory this morning, but I feel that the obstetrical lesson here is much more important than anything I could say to you in the line of therapeutics. This woman did not lose her life and she is not going to lose it, but she is just at the beginning of the trouble she is going to have. She is a woman in poor circumstances and she has nine children. She has already been incapacitated for a month, she will have to spend weeks in bed in the hospital, and she is probably going to have trouble from these legs for the rest of her life. I do not think I need labor the point further. This is a typical example of a mismanaged obstetrical case, and the lesson from it is plain.

ABDOMINAL PREGNANCY AFTER CESAREAN SECTION FOR ECLAMPSIA

This patient, a white female, nineteen years of age, presents a very interesting and unusual history, the details of which I shall ask Dr. King to rehearse for you, as she was in his charge during her previous stay in the hospital.

Dr. E. L. King: The patient entered the hospital November 22, 1929, with a story of pregnancy which was expected to terminate about the middle of January and which had been without incident of any sort until two days before admission. At that time she had some abdominal pain, not very severe, which she took for beginning labor pains, and there was also a slight vaginal bleeding. Both the pain and the bleeding were of short duration, but on the advice of her local physician she entered the hospital, with a diagnosis from him of threatened premature labor.

Her previous history concerns us in only one regard, that at her first and only pregnancy, two years before, she was delivered by cesarean section on the indication of eclampsia. Her recovery was smooth and uncomplicated and she was discharged on the eleventh day.

Questioning after her admission revealed the fact that there had been no fetal movements since the onset of the pain two days before, and we therefore concluded that fetal death had occurred, which was later confirmed by *x*-ray. The position we diagnosed tentatively as a breech; actually it seemed a cross between breech and transverse, a finding which should have excited our suspicion but which unfortunately did not.

Once the diagnosis was definite, induction of labor was decided upon, and a catheter was inserted, with a firm pack behind it, the uterus first having been explored by a sound. No results were obtained, and five days later a bag was inserted. The catheter was not accessible, it was noticed, but again, most unfortunately, our suspicions were not excited. Four days after the insertion of the bag signs of peritoneal irritation ensued, and it then occurred to me that possibly the condition was not as simple as we had concluded it to be. My diagnosis of peritonitis was concurred in by Dr. Alton Ochsner of the Department of Surgery, who saw the patient with me in consultation. My conclusion at this time was that we were dealing with a ruptured uterus, the rupture probably having occurred at the time of the pain which the patient had complained of two days before admission. I explained the absence of shock and other symptoms and signs on the theory that the scar must have been very thin and that the rupture had taken place without much bleeding.

Immediate laparotomy revealed the child lying in the peritoneal cavity, with the membranes still intact. The placenta was attached to the omentum, which was adherent in a sort of shelflike fashion to the uterine fundus. The incision in the uterus was wide open and evidently had been for some time. Below the incision were dense adhesions to the abdominal wall, and the lost catheter was lying free in the peritoneal cavity. Because the child was dead there was no circulation to cause technical difficulties, and it was a relatively simple matter to remove both fetus and placenta. Nothing further was attempted because of the extreme friability of all the tissues; hysterectomy was out of the question, and even resection of the tubes would have been unwise. Drainage was instituted because of the peritoneal infection. The first thirty-six hours were stormy, but thereafter the convalescence was smooth. The patient was discharged in excellent condition January 7th, and she returns now for such surgery as will guard her against a repetition of this accident.

Dr. Miller: This very remarkable story suggests several points for discussion. The first is the matter of eclampsia as an indication for cesarean section. At one time it was a routine indication; everybody delivered women suffering from this complication and from other toxemias of pregnancy by the abdominal route. But when we began to check our results, we found that we were not decreasing the mortality, and it was an open question as to whether we were not increasing it. In the study from the New Orleans hospitals made some years ago by the New Orleans Gynecological and Obstetrical Society, the mortality in cesarean section for eclampsia was found to be 41.5 per cent, certainly not a figure to be viewed with complacency. Today abdominal delivery is rarely resorted to in eclampsia unless there are obstetrical indications. We treat the patient and her toxemia by some one of the approved methods—personally I prefer the Stroganoff—and for the time being we ignore the obstetrical factor.

The fact that this patient recovered from the operation still does not weaken my point. Future pregnancies must be considered, as well as the current one. Young women exhibit the largest percentage of toxemias, and young women, in the nature of things, are likely to have other children. A patient delivered by cesarean section, no matter what the indication, always runs some risk in her future pregnancies. She must be under the observation of an experienced obstetrician throughout. I want to impress upon you that it is not only during labor that rupture takes place. It is most to be feared then, but it can occur any time after the sixth, or even after the fifth month, under the stress of the normal rhythmical uterine contractions which go on throughout pregnancy. A patient once delivered by cesarean section must always be delivered in a hospital in the future, and no matter what mode of delivery is adopted, a spontaneous labor or a second laparotomy, her obstetrical course is always more dangerous than it would be without the history of a previous abdominal delivery. In a spontaneous labor she runs the risk of a ruptured uterus, in a repeated cesarean she runs the risk inherent in all abdominal deliveries, and I shall show you a little later that it is a very real one.

Rupture of the uterus is no myth. It occurs in 4 or 5 per cent of all cesarean sections and, as I have said, we have no way of knowing when it is going to occur. Fifteen months ago I lost a patient two days before the date appointed for her third cesarean section, the appointed date being at least ten days ahead of the time of her estimated confinement because of her past history and the fact that she lived in the country. She ate a hearty lunch, had a vomiting spell an hour later, and in twenty minutes she was dead from a ruptured uterus, although she was just two blocks from a well-equipped hospital. Nor did immediate laparotomy save the child. I repeat that rupture of the uterus is no myth. It furnishes many of the tragedies of cesarean section.

Why it occurs we do not know. Faulty technic is not a sufficient explanation. We have at various times closed the uterus with all sorts of suture material, absorbable and nonabsorbable, and with every sort of technic, and always ruptures have followed. Do not misunderstand me. Many women who have been delivered by cesarean section have had safe spontaneous labors later. I have delivered many such patients myself. But my point is that these women must always face the chance of rupture, and rupture in a large majority of cases means death for the mother, aside from the fact that it means almost routine death for the child.

What went wrong in this particular case I cannot say. I have no doubt that the technic was correct, and according to the patient's story, which is likely to be correct, her recovery was entirely uneventful. If her convalescence had been stormy, we might have attributed the later trouble to infection, but it is only fair to add that studies of representative series of cases have shown that weak scars and febrile postoperative courses are not necessarily concomitant. On the surface we should have been justified in assuming, provided that the child was not out of proportion to the bony pelvis, that this woman could have gone safely through a normal pregnancy and a spontaneous labor. And yet see what happened to her.

In discussing the diagnosis in this case I speak in no spirit of criticism, for it would be very easy to fall into the same error. There was nothing in the story to suggest uterine rupture. Abdominal pregnancy is exceedingly rare. Abdominal palpation, usually characteristic in full-term extra-uterine pregnancies, was not so in this case. Ordinarily, as you know, the child is more clearly outlined than is usual because it lies outside the uterine cavity and because it lacks the fluid which normally surrounds it. But in this case, Dr. King tells us, the membranes were still intact, the story was misleading, and there was nothing in the physical findings to suggest that rupture had occurred. As a matter of fact, the uterus was probably open from the time of the first operation, and the child must have slipped out into the abdominal cavity rather early in the gestation. If this was not the case, then there must have been only a very thin scar and rupture must have occurred quietly, for at no time was there a picture of shock and hemorrhage.

The principal consideration in the management of abdominal pregnancy is the time of operation. Ordinarily this type of patient goes on to term and has symptoms suggestive of labor, uterine contractions, and possibly a bloody discharge. Then the discomfort disappears shortly and the child dies immediately or in a very short time. Many authorities believe that operation should be done as soon as the diagnosis is definite, others that operation should be done when labor ensues, and still others that it should be deferred until fetal death has definitely occurred. Many of the authorities in favor of early operation take their position on the ground that the child can be entirely disregarded, and there is something to be said for that argument. Many, indeed most, of these children are not perfectly normal, though it cannot be said that none of them are. Never and always are poor words to use in medicine; they have a disconcerting way of tripping you up. Just this past week I saw in a St. Louis clinic a woman who had had a simultaneous intra-uterine and extra-uterine pregnancy. Both children were delivered alive and well, the latter by laparotomy, of course, and it lived for five months, death being due, as I understand it, to intercurrent disease. But that is exceptional; as a rule these babies are deformed and need not be given undue consideration.

Personally I prefer to operate after fetal death has occurred, when the placental circulation is obliterated and the problem of hemorrhage is a minor one. The management of the placenta with an active circulation is frequently very difficult. Removal of the child is usually simple, removal of the placenta is often very complicated, and death from hemorrhage may follow persistent and unwise attempts. Also the placenta may be so adherent to coils of intestine that intestinal resection may be necessary to extirpate it, or it may be adherent to vital structures which cannot be removed.

One of the older methods was marsupialization, the sac being packed with gauze and the placenta being allowed to slough out later, but I need not point out to you the dangers of such a procedure, quite aside from the obvious risk of future hernia. At the present time the accepted plan, if the placenta cannot be removed with a minimum of risk, is to cut the cord close to the placental margin, tie the stump firmly, and leave the placenta *in situ*. It will atrophy, and most of it will be absorbed and eventually disappear. In this instance the placenta was attached to the omentum and received no intra-uterine sustenance at all. Its removal was simple, but its point of attachment is another interesting consideration in a case which is freakish in many directions.

The problem now is what we are going to do with this woman. Her improvement has been rapid and she is in excellent general condition at this time. The abdominal scar is well healed except for a small sinus at the point of drainage, from which there is a slight serous ooze. I have not examined her vaginally so I do not know the condition of her uterus. Dr. King says that at the time of his operation it was about double the size of the fist, and the enlargement, of course, was natural, for the uterus always enlarges in an extra-uterine pregnancy because of the decidual development.

Shall we repair this uterus? I question whether we shall be able to close the rent successfully. We know from Dr. King's story that many adhesions are present, and that suggests that the anatomy is likely to be very much distorted. Moreover, if we simply sew up the uterus, what guarantee have we that this same accident will not occur again? This patient apparently had a correct closure at her first operation, and yet see what happened later. It is seldom possible to secure a really good result in the repair of a ruptured uterus. I recall one patient whom I saw with Dr. King many years ago, twelve hours after rupture had occurred. The wound was perfectly clean and not at all jagged, so I took a chance and sewed it up. She had another rupture two years later, and that time she lost her life. So conservatism in cases like this is not a very wise plan.

Shall we resect the tubes, leaving the uterus and the ovaries in place, thus permitting menstruation to continue? From the standpoint of safety, that could be done, for I think the chances of menstrual blood being extravasated into the peritoneal cavity are slight. I should not be surprised if this uterine wound is not already well walled off and the peritoneal cavity already protected against such an occurrence. Moreover, granting that it did happen, I do not think the danger would be very great. This woman furnishes a beautiful illustration of what the peritoneum can do to protect itself against infection. It was certainly sorely tried. But this procedure has a purely sentimental value, menstrual irregularities are likely to follow in its train, and I question whether this woman, if the situation were explained to her, would care to have it done.

I think supravaginal hysterectomy is the safest plan from every point of view. Suture of the uterus, with the amount of scar tissue present, is not likely to be very satisfactory, and I question whether the wound would hold in another pregnancy. As to resection of the tubes, with an adherent uterus such as I am sure we shall find here, there would certainly be menstrual irregularities. If a fairly normal organ were present, without adhesions and with a good musculature, I admit that the situation would be different. Our aim is to get this patient well, and I think it will be best achieved by removing an organ that is badly damaged and whose function would always be depraved. The preservation of the ovaries will prevent her being tossed into a premature menopause and she will probably be perfectly well.

I want to revert again to the fact that this woman's first operation was not done for an obstetrical indication. Cesarean section should not be done for any other reason, though it is regrettably the custom in many quarters to do it for promiscuous indications or none at all. I believe in cesarean section, I would not be misunderstood on that point, but I believe in it only for very definite indications. It is not a trivial operation. It has a very definite risk and a correspondingly definite death rate. In a dozen hospitals it will average 10 or 12 per cent, the risk increasing in proportion to the looseness of the indications, the percentage of infected cases and the skill of the surgeon. An operation with a death rate like that is dangerous, and the fact that single surgeons report series of cases without a fatality does not lessen the risk in the average hands. Skilled obstetricians get good results not by superlative technic, but by superlative judgment in the selection of cases for the procedure. Take a hundred young women who are undergoing a supposedly physiologic process and submit them to an operation with a risk of 10 or 12 per cent, and you will realize just how dangerous cesarean section is.

This young woman has run enough risks. She had the risk of her cesarean section two years ago, done for an indication in which the mortality ranges above 40 per cent. She might have lost her life when rupture occurred. She might have died of sepsis produced by the various attempts to precipitate labor; she certainly had the wrong sort of treatment then because the diagnosis was incorrect. She might have lost her life when Dr. King operated on her three months ago, for the operation was not a simple matter. And she has before her the risk of another abdominal operation this week. She has been using up her luck rather recklessly, and it is up to us to see that she takes no further chances.

Note.—At operation two days later it was found that the previous cesarean section had been done by a technic so high as to suggest that of Fritsche. The uterus had involuted almost to normal size, and the rent in the wall was covered with peritoneum except at the upper end, from which point the sinus described in the abdominal scar took its origin. Only the mucosa and the peritoneum had taken part in the process of healing, and supravaginal hysterectomy was the only procedure which could be considered. The operation was completed without difficulty and the patient made a prompt and entirely uneventful recovery.

CLINIC OF DR. BARNEY BROOKS

VANDERBILT UNIVERSITY MEDICAL SCHOOL, NASHVILLE

ANEURYSM OF THE AXILLARY ARTERY

A Case of Spontaneous Aneurysm of the First Portion of the Axillary Artery Associated with Unilateral Clubbing of the Fingers and Dupuytren's Contracture.

Preoperative Condition.—G. C. H., white male, forty-five years of age. Admitted to the Vanderbilt University Hospital February 24, 1930.

Clinical History.—Patient's occupation is that of a bookbinder. General health and strength have always been good. Approximately twenty years ago, when the patient was twenty-four years of age, he began to have occasional attacks simulating epileptic seizures. In the beginning the attacks were separated from each other by long intervals. About ten years ago, the attacks became more frequent, appearing approximately once each month. At this time he began to take sedatives and for the past few years he has taken 5 grains of luminol each day. This drug has apparently given the patient relief from his epileptic seizures.

Patient has been married three times. First wife died of influenza. Second wife died of cancer. Third wife living and well. He has two children living and well. Patient has no knowledge of ever having had any of the clinical manifestations of syphilis.

About September 1, 1929, the patient became aware of a progressive loss in weight and strength. He consulted a physician and was advised that his illness was the result of pyorrhea and high blood pressure. The blood pressure was found to be 190. At this time the patient remained in bed for a week, at one time during which he had fever, but no pain. He resumed his work. All of his teeth were extracted. Subsequent examinations revealed a marked decline in the blood pressure. He never recovered completely his loss in weight and strength.

About the middle of December in 1929, he began to notice pains at irregular times throughout his right arm. The pains became progressively more severe and the intervals of comfort entirely disappeared until the patient suffered continuously from pain throughout the entire right upper extremity. About January 1, 1930, he noticed a small lump below the right collar bone. This lump has gradually increased in size.

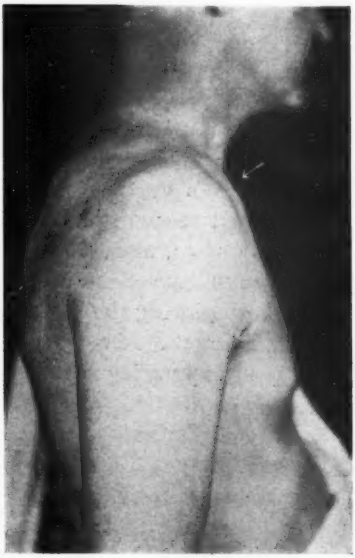


Fig. 287.—Photograph showing the site of the pulsating tumor.

Examination.—On examination, the patient is a fairly well-nourished muscular man. The mucous membranes are distinctly pale. There is a visible pulsating tumor immediately below the right clavicle (Fig. 287). There is definite palpable expansile pulsation. No thrill. Pressure on the right subclavian artery in the neck is followed by a cessation of pulsation in the tumor. On auscultation, there is well-defined blowing systolic murmur.

No diastolic murmur. The veins of the right arm are slightly fuller than those of the left. The strength of the right arm is definitely less than normal. There is no demonstrable motor or sensory paralysis. The right radial pulse is not quite as strong in the wrist. The blood pressure in the right arm is 110/70, left arm 136/80.

Examination of the patient's hands discloses a very remarkable finding. The left hand is apparently entirely normal. The fingers of the right hand show definite clubbing which is most marked in the middle and ring fingers. The terminal segments of the fingers are bulbous. The nails show exaggeration of the longitudinal curvature (Fig. 288). In the palm of the hand there is a thickening and contracture of the palmar fascia at the base of the third and fourth fingers. The band of thickened contracted palmar fascia extending to the base of the fourth finger is more pronounced than that extending to the base of the third finger (Fig. 289).

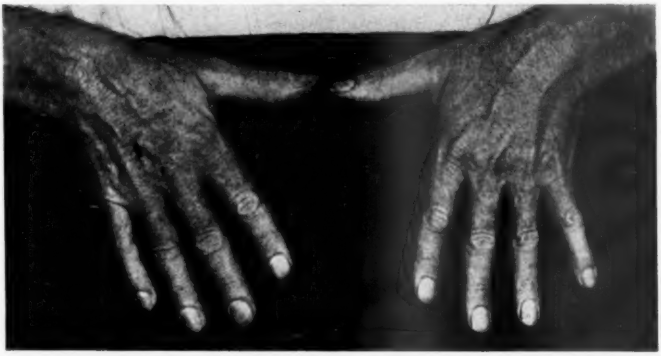


Fig. 288.—Photograph showing the appearance of the fingers of the two hands. The amount of clubbing of the fingers of the right hand was greater than appears in the photograph.

General physical examination of the patient discloses no evidence of disease other than that found in the right upper extremity. The heart is normal. *x*-Ray photograph of the cervical spine shows no evidence of cervical rib. The Wassermann reaction, both of the blood and of spinal fluid, was negative. Roentgenograms of the bones of the right arm disclosed nothing abnormal. The phenolsulphonphthalein kidney functional test revealed a normal excretion. Urine normal. Red blood cells 4,350,000. White blood cells 6100. Hemoglobin 90 per cent. Nonprotein nitrogen 27.9 mg. per 100 cc. Blood sugar 64.5 mg. per 100 cc. Clotting time two and a half minutes. Blood grouping four.

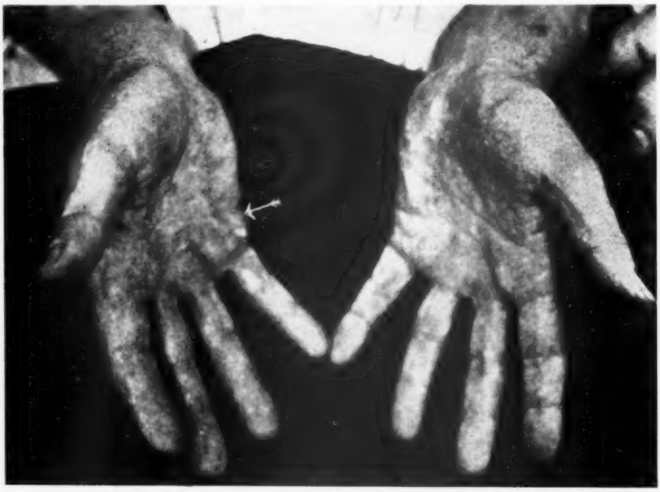


Fig. 289.—Photograph showing the characteristic Dupuytren's contracture in the palm of the right hand. The drumstick appearance of the middle finger of the right hand is also apparent.

Attempts to make use of the clincial methods of determining the capacity of the collateral circulation about the site of the aneurysmal tumor were unsatisfactory because the tumor was covered over by the rigid clavicle and the strong pectoral muscles. With an oscillometer on the forearm, oscillations were still observed after the greatest possible effectual obliteration of the aneurysmal sac by pressure.

In order to observe the possible relationship of the oxygen content of the blood of the right hand and the clubbing of the fingers, the blood gases were determined in samples of blood removed from the brachial artery and superficial veins of both hands. The results of these analyses are as follows:

	Volume per cent.
Left venous oxygen	11.81
Right venous oxygen	15.00
Arterial oxygen	16.54
Left arteriovenous difference	4.73
Right arteriovenous difference	1.54

The condition presented by the patient previous to operation briefly summarized is as follows: Patient is a man forty-five years old whose general physical condition is good. He is suffering from a spontaneous aneurysm of the terminal portion of the subclavian artery of the first portion of the axillary artery. There was no demonstrable evidence other than the aneurysm for suspecting the presence of a syphilitic infection. The circulation in the extremity, supplied by the diseased artery, was not seriously impaired. The pains from which the patient complained were of the character which would be best explained by pressure of the aneurysmal tumor from the brachial plexus. There was a definite clubbing of the fingers of the hand of the affected side. There was also a contracture of Dupuytren in the palm of the affected side. Operative treatment of the aneurysm was indicated.

Operation.—An oblique incision approximately at right angles to the clavicle was made extending from the base of the neck to the anterior axillary fold. A second incision was made perpendicular at the midpoint of this incision extending toward the midline. The flaps of subcutaneous tissue and skin were reflected. Periosteum of the clavicle was split and freed from the middle third of the shaft of the bone. The clavicle was divided in its middle third. Approximately 4 cm. of the middle of the shaft of the bone was removed. The elevated periosteum was divided transversely. The subclavian artery was isolated at the level of the superior margin of the clavicle. The vessel was apparently perfectly normal at this site. A tape was passed under the vessel. The pectoralis major muscle was retracted inferiorly.

This exposed the anterior aspect of the aneurysmal tumor which was found to lie between the superior margin of the pectoralis minor muscle and the inferior margin of the clavicle. The tumor was approximately 6 cm. in diameter. On further dissection it was found that the aneurysmal tumor was composed of the aneurysmal sac, the axillary vein, and the cords of the brachial plexus fused into one mass. The terminal portion of the subclavian artery was isolated just proximal to the aneurysmal sac and a tape was passed about the vessel at this point. Obstruction of the vessel at this point caused the aneurysm to cease pulsating, but diminished very little the tension within the aneurysmal sac. The second portion of the axillary artery just distal to the aneurysmal tumor was then isolated and a tape passed about it. This portion of the artery also appeared quite normal. With complete obstruction of the artery, both proximal and distal to the sac, the tension in the aneurysmal tumor was still sufficiently great to make it seem unwise to incise the sac. On further dissection, the cords of the brachial plexus were freed from the aneurysmal tumor. It was then noted that some vessels arose from the posterior aspect of the aneurysmal tumor and apparently passed to the chest wall. A long clamp covered with rubber was placed upon the tissue containing these vessels. This apparently stopped completely all flow of blood into the aneurysm (Fig. 290).

After complete control of the blood supply of the aneurysmal tumor the sac was opened. It was found to contain a considerable amount of lamellated thrombus. After the thrombus was removed the exact nature of the aneurysmal dilatation was strikingly evident. The aneurysmal tumor was formed entirely by dilatation of the anterior wall of the artery. The posterior wall of the artery apparently remained quite normal and formed a distinct yellow band connecting the afferent and efferent openings of the aneurysmal tumor. In this band could be seen the openings of the origins of three arteries. (These were the branches passing from the aneurysmal sac posteriorly to which previously a rubber-covered clamp had been applied—Fig. 291.)

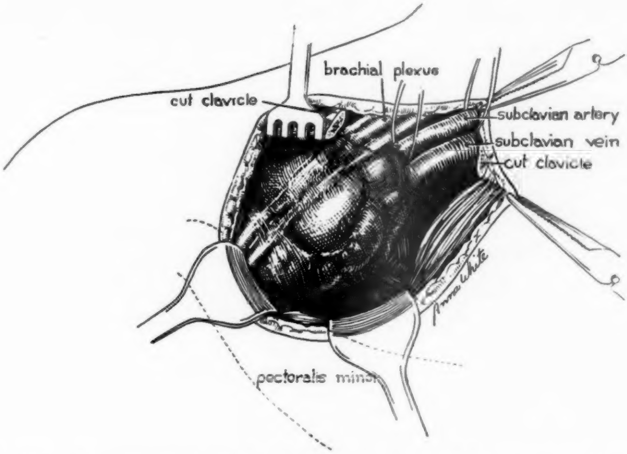

brachial plexus
cut clavicle
subclavian artery
subclavian vein
cut clavicle
Anna White
pectoralis minor

Fig. 290.—Diagrammatic sketch showing appearance of the aneurysmal tumor after exposure by operation.

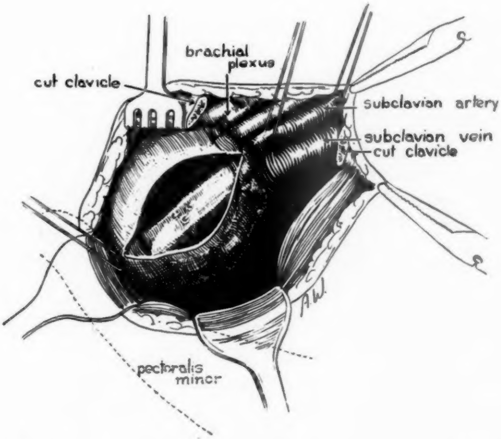

brachial plexus
cut clavicle
subclavian artery
subclavian vein
cut clavicle
A.W.
pectoralis minor

Fig. 291.—Diagrammatic sketch showing the appearance of the aneurysm after it was opened and all thrombus removed. The definite demarcation of the normal posterior wall of the artery forming a part of the aneurysm sac is little if at all exaggerated in the illustration. The origin of the vessels arising from the aneurysm sac are also shown.

At first it seemed possible to reconstruct the artery from the narrow band of normal arterial wall which formed a part of the posterior wall of the aneurysmal sac. This reconstruction was begun at the distal aspect of the aneurysmal tumor, and the edges of the remaining normal arterial wall were approximated with interrupted silk sutures. The reconstruction was entirely satisfactory until the most proximal aspect of the aneurysmal dilatation was reached. Here the arterial wall was found so friable that sutures would not hold. The reconstruction was then terminated proximal to the openings of the branches arising from the aneurysmal sac. The subclavian artery was ligated immediately proximal to the aneurysmal tumor. The lateral aspect of the wall of the aneurysmal sac from which the cords of the brachial plexus had been dissected was cut away. The medial aspect of the aneurysmal sac was in part adherent to the axillary vein. It seemed unwise to attempt to separate the sac and the vein. Only that portion of the aneurysmal sac which was not adherent to the vein was cut away (Fig. 292). The clamp and tapes controlling the blood supply of the aneurysmal tumor were then removed. No bleeding was observed. The wound was closed with interrupted fine silk sutures so placed as to obliterate as much as possible all dead space. The periosteum of the clavicle was closed so as to include the ends of the divided bone. The subcutaneous tissue and skin were closed with interrupted silk sutures.

Immediately following the operation the hand was quite pale and slightly cyanotic. It did not feel cold however. After recovery from the anesthetic the color of the hand was distinctly better, there was no impairment of sensation and no evidence of any motor paralysis. The patient remained in the hospital for three weeks after operation. On the ninth postoperative day patient developed slight fever which was associated with pain in the left chest and an audible pleural friction rub. Signs of a mild pleuritis were present for approximately one week, after which time the patient had no fever and no discomfort. Routine physical and *x*-ray examination of the chest failed to disclose any evidence of consolidation. Whether the pleuritis was primarily infectious in origin or was the result of pulmonary embolism, could no be determined.

Four weeks after operation, the patient resumed light work in bookbinding and examination six weeks after operation showed that, except for slight swelling of the arm and some stiffness of the fingers, the extremity was quite normal. At this time the right radial pulse was faintly palpable. The entire forearm and hand were slightly hyperemic.

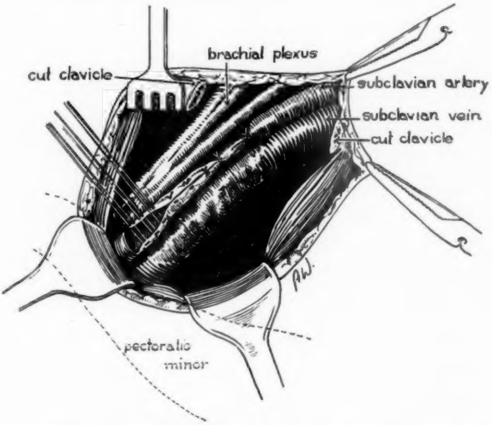


Fig. 292.—Diagrammatic sketch showing the technic of obliteration of the aneurysm. In the illustration the order of sequence in placing the sutures is reversed. At operation the sutures which are shown in the illustration as incomplete were placed first. As explained in the text, it was found impossible to complete the reconstruction of the artery in the proximal aspect of the sac.

Discussion.—This patient represents a condition which is apparently unique.

Traumatic aneurysm of the axillary artery is not particularly rare. Spontaneous aneurysm of the axillary artery is extremely rare. In fact, in the examination of several comparatively large series of reported cases of aneurysm, no record of an instance of spontaneous aneurysm of the first portion of the axillary artery has been found. There was no evidence in this patient of any traumatism which could be considered an etiologic factor. Furthermore, there was no evidence which indicated that the aneurysm was due to syphilis. The condition of the artery as observed at operation, as well as the absence of any other evidences of syphilis, are contrary to the opinion that syphilis was an etiologic factor. In this instance the afferent and efferent arteries, as well as the part of the arterial wall opposite the aneurysmal dilatation, appeared perfectly normal. Syphilis does not produce such circumscribed arterial disease.

The other clinical manifestation shown by this patient is of even greater interest and no doubt of rarer occurrence than the nature and site of the arterial aneurysm. This clinical manifestation is the presence of clubbing of the fingers of only one hand. The enlargement of the distal segments of the fingers together with the development of a marked longitudinal curvature of the fingernails has, from the earliest times, been noted to be associated with intrathoracic disease. It has been most frequently found associated with congenital diseases of the heart, and with long continued pulmonary disease such as bronchiectasis, pulmonary tuberculosis, or suppurative pleuritis. This condition has also been frequently found associated with the development of intrathoracic tumors and in some instances, particularly in rapidly growing mediastinal tumors, marked clubbing of the fingers has developed with great rapidity. In a very few instances, clubbing of the fingers of one hand has been described. Sir Thomas Smith described a case of unilateral clubbing associated with an aneurysm of the axillary artery in which the clubbing of the fingers became less marked after ligature of the subclavian artery in spite of the fact that the patient only lived for twenty days. Osler mentions having seen two instances of unilateral clubbing of the fingers associated with intrathoracic aneurysm. Groedel has described a case of unilateral clubbing of the fingers in an individual suffering from aneurysm of the arch of the aorta. From all of the literature to which I have so far had access, I have found no other instance than that reported by Sir Thomas Smith of unilateral clubbing of the fingers in which the supposed causative disease has certainly been entirely without the chest. One of the several explanations which has been advanced to explain this remarkable but obscure phenomenon is that it is caused by venous stasis. In this particular instance the relative volume flow of blood through the affected hand was tested by the determination of the differences in oxygen contents of the arterial and venous blood of the two hands. It was interesting to find that the venous blood obtained from the hand with the clubbed fingers contained a larger amount of oxygen than that found in the blood obtained from the presumably normal hand. It is worth while calling attention, however, to the fact that oxygen content of venous blood is such a variable factor that too much weight must not be given to this method as a means of estimating the rapidity of circulation. A condition which is not infrequently associated with clubbing of the fingers is the condition described by Marie as hypertrophic pulmonary osteo-arthropathy. Roentgenograms of the bones of this patient's arm and hand showed no evidences of the existence of this disease.

Although only six weeks have as yet transpired since the extirpation of the aneurysm from this patient, it is our impression that the clubbing of the fingers is definitely less than it was previous to operation. It will be extremely interesting to observe this patient after more time has elapsed in order to determine if the clubbing of the fingers completely disappears.

Although the knowledge we have gained from our experience with this patient has not disclosed any fact from which a specific explanation of clubbing could be derived, it would seem that the facts presented by this patient are very conclusive evidence for the belief that clubbing of the fingers is the result of some factor, the operation of which can be limited to one extremity. Since the most obvious abnormality in this individual's extremity is a derangement of the circulation, it would seem as if the cause of the so-called "hippocratic fingers" must lie in some abnormality of the physical conditions of the circulation. This is contrary to the theories which have assumed that clubbing of the fingers is the result of the absorption of toxins from long-continued suppurative processes in the chest.

The other condition which this patient exhibits is that of a contracture of the palmar fascia in the hand supplied by the diseased artery. The type of contracture which this patient has is characteristic of the contracture described by Dupuytren. The etiology of this condition is also entirely obscure. I believe the opinion is most frequently held that Dupuytren's contracture is the result of traumatism. In this particular instance the patient's occupation is that of a bookbinder. In such an occupation, the palm of the right hand is, according to his statement, frequently used for exerting pressure. It is, therefore, probable that the occurrence of a characteristic Dupuytren contracture in the palm of the hand of the diseased extremity in this patient is merely an extraordinarily unusual coincidence. On the other hand, it may be stated that fibrosis and contracture is not infrequently associated with mechanical interference with the blood vascular system. For example, varicosity of the superficial veins of the lower extremity is almost universally associated with the appearance of extensive fibrosis of the tissues of the leg. The condition occasionally encountered in the treatment of fractures, particularly about the elbow, known as Volkmann's ischemic contracture is almost certainly due to a marked mechanical obstruction of the veins.

It is possible that future observation of this patient may throw some light on the etiology of Dupuytren's contracture. Certainly one would be compelled to believe that a disappearance of this contracture during the continued engagement in the same occupation by this man would be very strong evidence for the belief that the contracture was in some way due to a derangement in the circulatory apparatus. This possibility is mentioned not so much because of its intrinsic importance, but to call attention to the fact that the accumulation of some of the most valuable knowledge in medicine has come, and will come, from the continued study of patients for long periods after the usual period of therapeutic interest has ceased.

In conclusion, it is worth while to emphasize at least a few important points concerned, particularly with the technic of the operation which has been performed on this patient. In general, it may be said that the methods of operative treatment for arterial aneurysm fall into two groups. One group includes the methods in which a direct attempt is made to obliterate the aneurysmal dilatation, and another group in which an attempt is made to obliterate the aneurysmal sac by operative procedures at a point more or less remote. Strange as it may seem, the first attempts at the operative cure of aneurysm, that of Antyllus in the fourth century, was for that time a bold procedure in which the afferent and efferent arteries were ligated and the sac was opened and packed. As any one having knowledge of the relationship existing between infection and operative procedure upon large arteries would surmise, this procedure in the course of time fell into disrepute undoubtedly because of the large proportion of cases dying of secondary hemorrhage. Previous to the time of John Hunter amputation, when possible, was in most instances the operation of choice for the treatment of aneurysm. John Hunter introduced the procedure now generally known as the hunterian operation. This method consists in the ligation of the afferent artery at a point considerably remote from the aneurysmal sac. Since the development of aseptic surgery, those whohave had most experience in the treatment of arterial aneurysm have gone back to methods of operation which are only slight modifications of the original Antyllus procedure. The application of these methods, which give much more favorable results, is possible because of our knowledge of sepsis, the prevention of which removes the risk of secondary hemorrhage. Unfortunately the great objections to the application of the hunterian operation are not as yet generally appreciated and aneurysm is still frequently treated by the application of the remote proximal ligature. I am quite certain that if John Hunter were alive today, his greatest regret would be the establishment and popularization of the so-called "hunterian operation."

The operation of choice at the present time for the treatment of aneurysm is either the complete extirpation of the aneurysmal tumor or the obliteration of the aneurysmal tumor, according to the Matas method. The choice of one or the other of these methods should be made according to the knowledge the operator has of the capacity of the collateral circulation immediately about the site of the aneurysmal tumor. In this particular instance it might be said that both of the methods, aneurysmectomy and aneurysmorrhaphy, were used. The greater portion of the aneurysmal sac was excised. A small portion of the sac containing the orifices of the vessels arising from the sac was treated according to the Matas method.

One other point is worth emphasizing. There is a valuable method of estimating the capacity of the collateral circulation about a site of proposed obstruction of an artery which is apparently not generally appreciated. The most accurate knowledge of the condition of the collateral circulation can be obtained after the exposure at operation of the aneurysmal tumor. The capacity of the collateral circulation, about any point in an artery to be obliterated, is best determined by temporary occlusion of the artery at this point and observation of the blood pressure in the artery distal to the occluding clamp. In this instance occlusion of the efferent artery just proximal to the aneurysmal tumor caused the tumor to cease pulsating, but did not cause it to become soft. After occlusion of both the afferent and efferent vessels, there was still a considerable tension in the aneurysmal tumor and in the efferent vessel distal to the temporary occlusion. This fact was definite proof for the existence of an adequate collateral circulation about the aneurysm. The persistent tension in the sac also indicated the connection between the aneurysmal tumor and the circulatory system was not sufficiently obstructed to make it wise to open the tumor until the vessels entering the aneurysmal sac were isolated and controlled. The competence of the collateral circulation about any site of proposed obstruction of a large artery is best determined by producing a temporary occlusion and observing in one way or another the intravascular pressure in the artery distal to the point of obstruction.

Subsequent Note.—Subsequent examination of this patient four months after operation shows a complete absence of any signs of aneurysm. Circulation in the extremity is apparently only slightly diminished. The right radial pulse is present, but of smaller volume than the left. The right hand becomes slightly paler than the left on elevation and more hyperemic on subsequent depression. There is still slight swelling and stiffness of the fingers. The slight swelling in the fingers makes it impossible to determine if there has been any diminution in the amount of "clubbing."

Further search through the medical literature has revealed records of other instances of unilateral clubbing of the fingers associated with aneurysm of the subclavian or axillary arteries. It is interesting to note also that spontaneous aneurysm of the first portion of the axillary artery is more frequently recorded in the old medical literature than in the more modern publications. A report of a study of the relationship existing between aneurysm of the subclavian or axillary artery and clubbing of the fingers is now being prepared.

CLINIC OF DR. HUBERT A. ROYSTER

Rex and St. Agnes Hospitals, Raleigh, N. C.

ANEURYSM OF THE BRACHIAL ARTERY; RECONSTRUCTIVE ENDO-ANEURYSMORRHAPHY

The case for consideration this morning is an unusual one. The patient is a man forty years old, a strong, healthy, intelligent farmer who consulted us a week ago in regard to a "swelling" on the inner aspect of his right upper arm. Twelve years ago he sustained a dislocation of the right shoulder brought about while attempting to handle a horse in a run-away accident. A prompt recovery ensued, and there has been no recurrence of the dislocation. About five years ago he first noticed under his right arm a lump which has gradually increased in size and which "beats."

The mass is easily felt. Close observation, even from a distance, discloses a pulsating enlargement along the inner side of the right upper arm, at the junction of the upper and middle thirds. The pulsation is expansile. The mass is about the size of a golf-ball, movable laterally, not tender. Pressure on the brachial artery above the swelling causes the pulsation to cease. General examination of the patient shows no other abnormality. The Wassermann reaction is negative. A diagnosis of aneurysm of the brachial artery, probably traumatic in origin, has been made.

The question of operation may be discussed. On the one hand, the patient suffers no pain and no disability, but found the swelling accidently; on the other hand, a constant danger exists in the probability of injury while pursuing his occupation, and there is every reason to suspect that the aneurysm will still continue to increase in size. Opinion against the necessity of immediate operation has been suggested by another surgeon.

Admitting the general soundness of this advice and knowing that aneurysms of the upper extremity, when of small size and giving no symptoms, may sometimes safely be left alone, nevertheless the patient, his physician and myself have agreed that, as the operation may be considered without danger, it would be best to get rid of the aneurysm as a potential hazard.

The pulse in the right radial artery at the wrist is palpable in its normal position and apparently the same as on the left. The circulation returns readily in the radial artery after removal of the Esmarch rubber bandage applied from the hand to the axilla. The blood pressure in the right arm is 116/60, in the left 120/60.

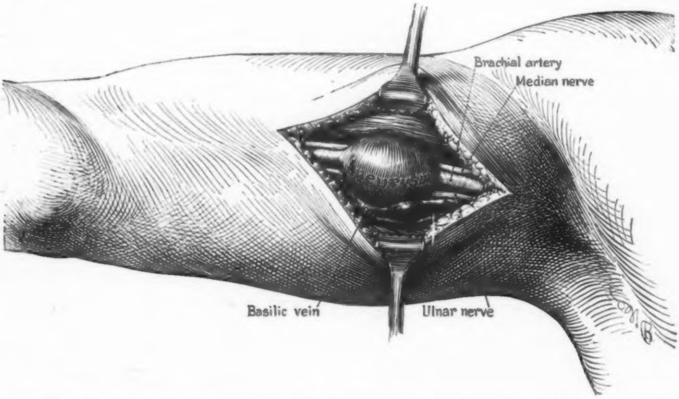


Fig. 293.—Traumatic aneurysm of the right brachial artery, with accompanying thrombus of the basilic vein.

Under local anesthesia by infiltration, and with a rubber tube tourniquet around the arm high up, a longitudinal incision is made over the aneurysm and the sac exposed. It is freed with little difficulty and a minimum of dissection, avoiding injury of the minor vascular branches and the neighboring nerve trunks. A dilatation of the basilic vein is seen, not connected with the artery (Fig. 293). The aneurysmal sac is thin walled, of the fusiform type and we will endeavor to do some form of endo-aneurysmorrhaphy. On opening the sac from above downward, two soft clots appear floating in the fluid blood which was somewhat thicker than normal. As the two openings into the sac are in the posterior wall, and fairly close together, it will be feasible, I believe, to do a reconstructive endo-aneurysmorrhaphy, making a new channel for the arterial blood. Accordingly a rubber catheter of a size to fit snugly into the openings, is cut short and introduced, one end into each opening. This will serve as a guide, upon which to sew over the first row of sutures. Interrupted No. 00 chromic catgut sutures are used and before these are all tied the catheter is withdrawn (Fig. 294). The sac is now sewed

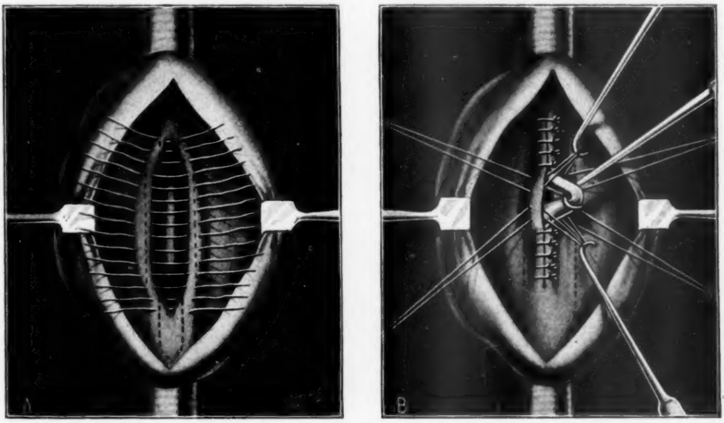


Fig. 294.—Reconstructive endo-aneurysmorrhaphy. A, Showing the method of closing the orifices and constructing a new arterial channel in a fusiform aneurysm. B, Removal of the guide. (Matas.)

with the same material from within in layers down upon the original line of sutures and folded over outside. As the tourniquet is being removed there is a slight leakage of blood at each end, which is controlled by two sutures of fine silk. Two inches of the basilic vein, including the dilated portion containing a large clot, are now resected between chromic catgut ligatures. Muscles and fascia are brought together over the operative area by a few plain gut sutures and the incision is closed without drainage. The patient has behaved well under the local anesthesia, his only complaint coming from pressure of the tourniquet. He will be placed in bed with his head and shoulders slightly elevated and his arm extended on pillows.

Postoperative Notes.—This patient had a comfortable convalescence. He had tingling and a stiff feeling in the fingers of his right hand, lasting a few days. The right radial pulse returned at once after the operation and was also felt the next day (December 19, 1929). For the following several days the pulse was barely palpable until the patient was discharged on the tenth day when it was again perceptible. The arm showed no swelling at any time and the incision healed properly. The blood pressure in each radial artery remained about the same as it was before operation. Three weeks after operation the patient reported at my office in good condition (Fig. 295).

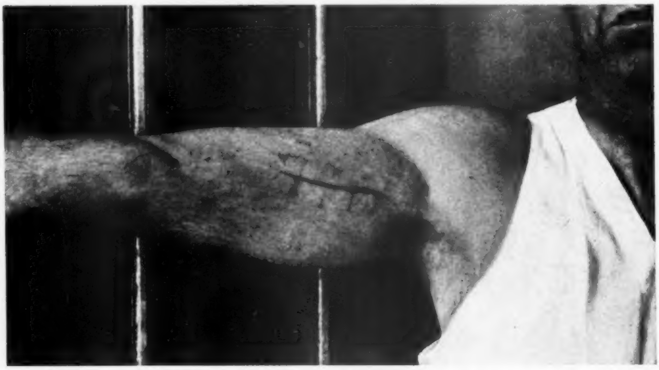


Fig. 295.—Patient three weeks after reconstructive endo-aneurysmorrhaphy for aneurysm of brachial artery.

Comment.—As a substitute for any remarks I might make upon this case, I could do no better than to quote at length from a personal letter recently received from Dr. Matas, to whom I submitted my notes. He writes: "As a rule, aneurysms of the brachial below the origin of the superior profunda do quite well with any of the three methods of endo-aneurysmorrhaphy. The anastomoses above and below the sac are quite plentiful and the collateral circulation is so free that the periphery suffers little from the obstruction of the main trunk at any level between the superior profunda and the bifurcation. *My first case of endo-aneurysmorrhaphy, which I reported in 1888, forty-two years ago, was an enormous traumatic brachial aneurysm in which ligatures immediately above and below the sac failed to control the circulation in the sac for this very reason—the great freedom of the collateral circulation. And it was the failure of the ligatures that led me to open the sac and close all the bleeding orifices within it by sutures.*"

"Unusually the radial pulse returns *after ligature* within a week or ten days. In one case in which one of my internes mistook the artery for a vein, while administering a saline infusion, the radial pulse returned on the second day. For this reason, all the open methods of radical cure including extirpation claim success in this region. But I believe that the intrasaccular suture in any of its forms is always the best operation, because it is the simplest, the least traumatizing, and reduces the segment of the obliterated artery to a minimum length, even when the obliterative suture becomes necessary. Furthermore, as in my first case—a large traumatic sac, I could not have extirpated it without sacrificing nearly the whole length of the artery and injuring the median, ulnar, and other nerves that were inseparably blended with the sac wall."

"When a reconstructive or a restorative operation is done, the interesting question that arises is whether the peripheral circulation has been restored through the sutured main artery, or through the collaterals. The best tests are: (1) The *immediate* return of the radial and peripheral pulse; (2) the return of the blood pressure, distal to the sac, to the same level of systolic and diastolic pressure as on the normal side. Of course, it is important, in order to arrive at legitimate conclusions, that the blood pressure should be carefully compared on both sides *before* the operation; because there are, at times, notable differences between the two arms in perfectly normal subjects. *When the radial pulse is lost immediately after the operation, it is a sign that the circulation is being carried on by the collaterals. Again, if the radial* *pulse returns immediately after the operation and then disappears or grows less perceptible in a few days, it is a sign that the main artery has been occluded by a thrombus or the lumen constricted by scar at the seat of the suture.* The blood pressure taken . . . at the same time will usually show a drop . . . below the site of the operation, in spite of an apparently good peripheral circulation."

It is interesting to note that among the known causes of traumatic aneurysms of the axillary artery are violent efforts in the reduction of shoulder dislocations. This might apply, as in the case just reported, to the brachial artery in its upper portion. The most recent report of this type—the only one for the past several years—is by Coenen[1]—a case of aneurysm of the brachial artery from crutch injury, with arterial thrombosis and gangrene of the arm.

[1] Zentralbl. f. Chir., liv, 2023, August 6, 1927.

HUGE ANEURYSM OF THE SCIATIC ARTERY SIMULATING A SARCOMA OF THE BUTTOCK

HERE is a colored man, LeRoy M., fifty-three years of age, who presents himself for advice concerning the removal of a very large tumor of the left buttock. It is of many years' duration, he does not recall how many; but remembers that about twelve years ago he sustained a fall on that hip in a tobacco factory in Durham. A year afterward he was sent to a hospital in Baltimore where operation was not advised. He went along for several years doing his work, but for the past few months has been incapacitated on account of pain down the leg and inability to stoop. He walks with a stick and has little use of his left lower limb. The tumor has been growing progressively during the past two months.

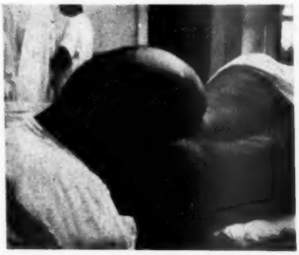


Fig. 296.—Large aneurysm of the left buttock, patient lying partly on abdomen with left thorax slightly elevated. Before operation.

The man's facial expression shows evidence of suffering. He is emaciated and, though he gets about, is obviously too weak to be up. The tumor occupies the region of the left buttock (Fig. 296) measuring about 14 x 12 inches across its surface; it is soft, spongy, not tender. No fluctuation is elicited and no pulsation is present. The whole mass is smooth and fixed. On the skin at the most prominent part of the swelling is a recent small scar, which the patient says was made by a trocar introduced a week ago by a physician who said that the result was a "dry tap." The *x*-ray films exhibited here show no abnormality of the bones or joints, and only a light shadow of the tumor outline. A specimen of blood has been sent to the laboratory for a Wassermann reaction. (Report on the blood three days after operation was 4+.) How much dependence may be placed on this man's history is a question. Patients of this class have no definite conception of time or sequence. If the duration of this mass corresponds to his memory, an old aneurysm may be thought of, even though no pulsation is felt; if the tumor is of more recent origin with its progressive growth and the man's poor general state, then sarcoma could be considered. At any rate it is our purpose to attempt removal of the mass.

With the patient under general anesthesia I proceed to make an incision lengthwise over the greater circumference of the tumor and remove an elliptical portion of skin 6 inches wide at the middle. Cutting down I find a sac filled with dense organized clots on the periphery, lamellated layers beneath those and soft clots further below. It is evident that we are dealing with an aneursym and the proper method now will be to remove the sac entire, if possible, securing the vessels at each pole. The gluteal muscles are being stripped back cleanly from the sac wall. Each extremity of the small, short pedicle is grasped by Ochsner forceps; the sac is cut away with its contents partly emptied. Similar forceps are applied to vessels which are spurting between. These are seized just as they emerge from the great sacrosciatic foramen. One of them could not be caught with forceps, but is being occluded with the finger. The mouths of the vessels are now sewed over and over with chromic catgut until they are perfectly sealed, using a portion of the sac and some muscle fibers to obtain obliterative pressure. Three distinct arterial openings are recognized—two branches of the sciatic artery, and an adventitious opening into the sac which may have been a subdivision of the vessel or the same vessel severed at a different angle. For a moment bleeding was free, as noticed, but not alarming, not even troublesome. No hemorrhage at all occurred until the arterial openings were reached above and behind the trochanter.

Muscles and fasciae are now sutured back into place, being overlapped as desired. Redundant skin has been cut away, a cigarette drain inserted, and the incision closed between its ends.

Clinical comment on this case will necessarily include criticism of the diagnosis and method of management. A significant statement by Rudolph Matas,[1] that master of vascular surgery to whom we all must go for information, is enlightening: *"It is easy to mistake these aneurysms (of the buttock), when they are filled with hard clot, for sarcomata or even abscesses."*

Among the rarer aneurysms are those of the internal iliac tract generally referred to as "aneurysms of the buttock." Those of greatest interest are dilatations or extravasations of the gluteal or sciatic arteries. The majority come as the result of traumatism either direct or indirect—the gluteal chiefly from stabs and the sciatic more often from falls on the ischium or buttocks, tearing the vessel at its exit from the foramen. Curiously enough the left side seems to be more commonly affected than the right and naturally the larger number occur in males.

The symptoms exhibited by the patient just operated on are those ordinarily seen: Subjective—lameness and pain due to pressure on the nerves; objective—pressure of a mass, usually small at first, appearing shortly after injury, rapid in development and, if of the sciatic vessel, nearer the tuber ischii, with freer lateral movement. All of the aneurysms are apt to end fatally, if left alone.

The modern treatment of buttock aneurysms would presume, first, ligation of the internal iliac artery, then free incision of the sac, and its obliteration by suture. At times ligation of the main artery only may suffice, but relapses are likely. Another striking statement by Matas, bearing on the present case: *"The smaller pathologic aneurysms of these same (gluteal or sciatic) vessels, which are well defined and circumscribed, outside of the sacrosciatic notch, may be treated most satisfactorily by a preliminary incision exposing the upper and lower poles of the aneursym followed by the extirpation of the sac."* This procedure appears to be adapted to the case under consideration, although the aneurysm was large and traumatic. At any rate for the lack of a positive diagnosis due to the absence of pulsation in the tumor the desired result has been accomplished. The fact that the sac was solid with clots caused it to resemble a sarcoma, but made it safe for the external operation.

---

[1] Keen's Surgery, vol. v, p. 341.

Just how rare are aneurysms of the buttock? Crist found five internal iliac aneurysms in a group of 551 cases of all types, and naturally the incidence of gluteal aneurysm is far below that figure; Rupp in 1907 collected 45 cases of aneurysm of the gluteal artery; W. D. Haggard reported a case (the size of a "salad bowl") in 1921 and stated that from 1916 to that time only 5 new cases had been recorded in current surgical literature. D. L. McGuire's case (the size of a "grapefruit") was operated upon in 1924 with

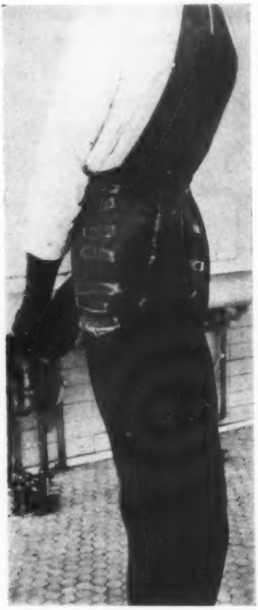


Fig. 297.—Patient two weeks after operation for huge aneurysm of the sciatic artery.

a successful result and one reported by Benjamin in the same year died unoperated. Following these, none appeared in the literature until the case just presented. The relative frequency of aneurysm of the sciatic artery has not been checked, but it is undoubtedly much rarer even than aneurysm of the gluteal artery.

Note.—The patient stood the operation well and made a prompt recovery. The incision healed satisfactorily. Figure 297 shows the condition of the parts two weeks after operation. As late as two years afterward, the patient reported that he was doing well and had no return of his trouble. Up to this time (April 1, 1930) no further case of buttock aneurysm has been reported.

FIBROSARCOMA OF THE ABDOMINAL WALL

THIS patient, a colored woman thirty-five years of age, has been married ten years and has had four children. Her menstrual periods are regular, painless, and the flow is not excessive. There is, as you see (Fig. 298), a large mass in her lower abdomen, reaching up as far as the umbilicus and as far down as the symphysis, overhanging the left pubic region. It is hard and smooth; since first discovered it has grown rather rapidly. Our first impression, of course, would be to consider this a uterine fibroid, but on pelvic examination it is found that the uterus is movable, about normal in size and is not connected with the mass, which is itself fixed. Our diagnosis is tumor of the abdominal wall, the nature of which is uncertain, but probably sarcomatous.

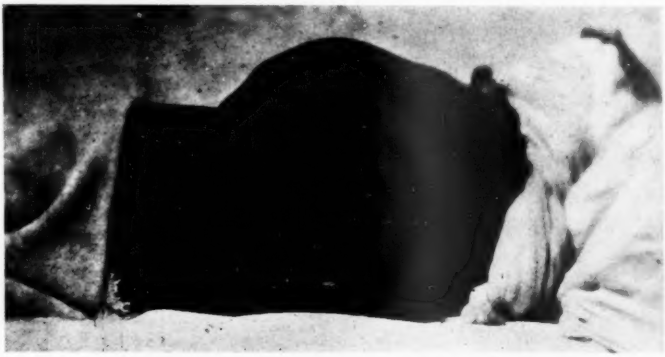


Fig. 298.—Large fibrosarcoma of the abdominal wall.

An incision is made longitudinally over the most prominent portion of the tumor. After separating the muscles and dissecting the tumor free, it is seen to spring from the fascia just beneath the symphysis pubis. It has grown upward between the peritoneum and the aponeuroses of the muscles, pushing them forward. The bleeding is active, but controllable by numerous clamps. At one point here in the upper part we have opened the abdominal cavity on account of firm adhesion of the peritoneum of the tumor. It is securely closed by suture. The entire mass is completely removed, leaving a large cavity. The oozing areas are secured and the wound closed in layers.

The tumor weighs 4½ pounds. The pathologist reports: "fibrosarcoma, spindle-celled type."

Tumors of the abdominal wall, especially of large size, are not very common. Of the smallest ones, superficial skin growths may be nevi, pigmented moles, or cutaneous sarcomata. Deeper growing tumors are the lipomata, the so-called "desmoids" (fibromata), and fibrosarcomata. Women seem more predisposed than men, and yet recurrences in the malignant types in women appear to be less frequent. Diagnosis of the particular kind of growth is often impossible before operation. Many of these tumors do not possess a virulent type of malignancy, even the sarcomata, but their early removal by surgical means is always indicated, since the prognosis is at best uncertain.

Note.—This patient was living and in good health two years following operation.

CONTRASTING DIAGNOSES

1. **Periosteal Sarcoma of the Forearm Compared with a Lymphangioma in the Same Region.**—Two patients will be exhibited to bring out points of difference between conditions which on casual glance appear to be similar. What might be called the gross examination, a general survey, will often furnish valuable information, if we employ our powers of observation in a keen and discriminating fashion. The senses of sight and touch can be trained to take in details quickly and accurately. First impressions may be lasting, but they should always be analyzed and checked up.

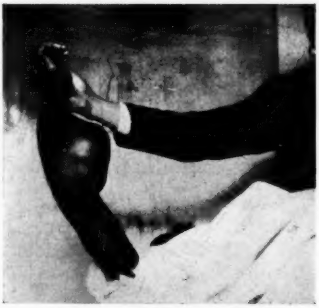


Fig. 299.—Periosteal sarcoma, right forearm.

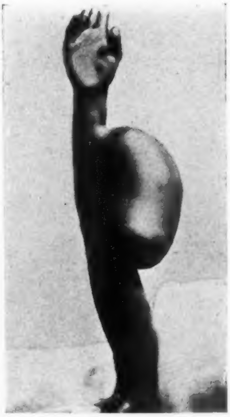


Fig. 300.—Lymphangioma, right forearm.

(*a*) The first case is that of a man aged forty-one years. He has a tumor on his right forearm, the size of a large cocoanut (Fig. 299). It is of six months' duration and followed closely upon an injury, a contusion from a weight falling on the arm. The mass is more or less fixed, having a slight up-and-down, but no lateral, movement; it is irregular in shape, moderately soft.

The patient suffers pain and has limited use of his hand. The *x*-ray picture shows no bone involvement, but a thickening of the periosteum. From the history and the examination we have no hesitation in declaring this a sarcoma.

(*b*) The second case, presented for the purpose of contrast, is an even larger tumor in the same relative area, occurring in a boy three years old. It was first noticed a few days after his birth as a small "puffy" swelling raised slightly above the skin. For a long time it increased slowly in size, but in the past few months it has taken on very active growth, until it has attained large proportions, reaching about from the elbow to the wrist (Fig. 300). It is loosely attached, flopping about with every movement of the arm; smooth, spongy in consistence, semi-fluctuating in spots, it gives the impression of a cystic mass with denser areas. Since the tumor is undoubtedly congenital in origin, of steady growth, with a springy "feel," one naturally thinks first of an angioma. Simple excision with closure of the skin will be done.

2. (*a*) **Elephantiasis Contrasted with Tertiary Syphilis of the Leg.**—Here is a case, the first to be shown, of a widespread affection on the skin of the left leg. The right leg is almost as bad. The patient is a colored girl of nineteen years, inmate of a county home. The condition has existed more than two years.

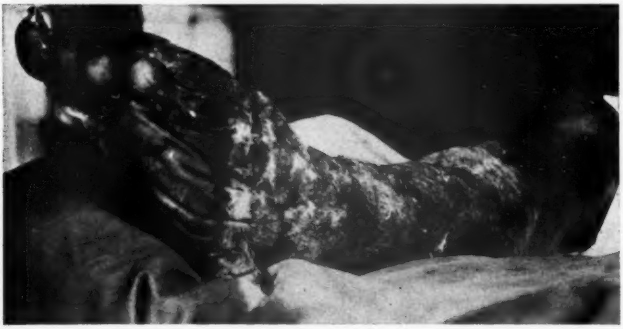


Fig. 301.—Elephantiasis of the left leg.

The skin all over the leg is dense, indurated, brawny; the foot is thick through and covered on the dorsum by horny projections. The involved area extends nearly up to the knee, uniformly upon all aspects of the leg (Fig. 301). The blood Wassermann test is negative, and there are elsewhere in this patient no evidences of syphilis. Some of those present will recognize this condition as a true elephantiasis, several cases of which have been operated on in this clinic. The general characteristics of this disease are unmistakable. This patient will be prepared for the Kondoleon operation.

(*b*) There are, however, elephantoid lesions in many patients which might be confused with typical elephantiasis. The next case will illustrate the difference: A woman of forty-five years, who gives a history of successive miscarriages and the births of several premature babies up to five years ago. In the past two or three years there were several nodules in different parts of her body (neck, abdomen, and legs) which disappeared under treatment. Her blood examination a year ago showed a Wassermann reaction of 4 plus. The condition of her left leg is our immediate concern (Fig. 302). You will see that there are two or three old, callous, deep-set ulcerations near the ankle. The skin and underlying tissues are so eroded as to expose the bones. The foot is greatly enlarged and very hard; there is a rather ex-

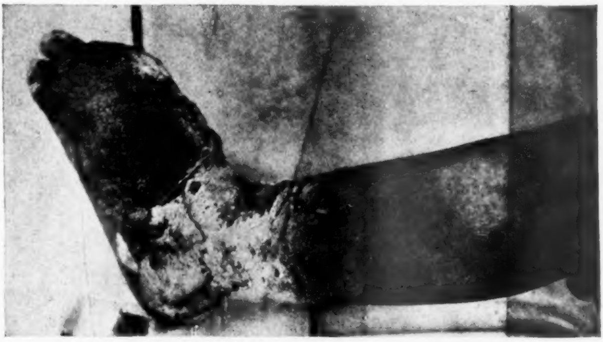


Fig. 302.—Tertiary syphilitic lesion of left leg and foot.

tensive loss of tissue on its dorsal aspect. Almost the foot is separated from the leg, and it is perfectly helpless. From a point 3 inches above the ankle the leg is unaffected except for induration due to blocking of the lymphatic and blood vessels. This condition, we believe, is the result of tertiary syphilis. Prolonged and proper treatment seems not to have been efficacious for this particular lesion. Unalterable organic change very likely precludes any further improvement. Amputation just below the knee has been recommended.

CLINIC OF DR. URBAN MAES

FROM THE DEPARTMENT OF SURGERY, TULANE UNIVERSITY SCHOOL OF MEDICINE, AND THE CHARITY HOSPITAL, NEW ORLEANS

GLIOSARCOMA, PROBABLY OF RETROBULBAR ORIGIN

THIS is a white male child, seventeen months old, whose history has been secured with difficulty, since the mother is an Italian, speaking English poorly and of a rather low-grade mentality. She gives a story of the child's having fallen about a month ago, striking his head against a table leg. Two or three days later it was noticed that the left eye protruded and that there was some swelling in the left temporal region. A few days later the same region was injured by a blow from a swinging door, and since that time both the swelling and the protrusion of the eyeball have increased rather rapidly. The child has been crying and fretful since the onset, but sleeps well at night. There have been vomiting spells at irregular intervals since the onset of the illness. There has been some loss of weight, though the exact amount is not known. The baby is partly breast-fed, partly bottle-fed, and nourishes fairly well. At present his temperature is 100 F. and his pulse 140., but we have no information as to whether the temperature elevation has been present since the onset of the illness. The previous history has no bearing on the present condition. (Student's history.)

Physical examination shows a very poorly nourished, pale, cachectic child. There is a very distinct bulging of the left eye with a tumor mass filling the left temporal fossa, soft and of uniform consistency. A tremendous increase is noted in the superficial veins of the skin. There is also a markedly enlarged group of glands in the left side of the neck. Other physical findings are negative.

In the first place, while we have no definite information as to the progress of the illness up to this time, I think we may safely consider it afebrile. One of the glands of the neck has just been removed for biopsy, and I think a slight wound infection may account for the mild pyrexia.

In this case we shall have to base our diagnosis largely upon the appearances present. Clinical sense and experience must help us here, for we have little else to go on. The history cannot be relied upon. The mother is an Italian woman who speaks poor English, and who has eight other children. Can we rely upon her sequence of events? I think not. Minor ailments are not apt to be especially noted in so large a family and in people of this station, and this condition may have existed, probably did exist, long before it was especially noted. The woman has told at least three different stories of the injury, and in my opinion we can discount them all. She noticed the tumor because of the injury, but I do not think it was cause and effect.

The laboratory does not offer much help. The gland which was removed has not yet been reported on. *x*-Ray examination of the skull shows some thinning of the bones, markings of the convolutions, and a separation of the fissures. These are findings that go with intracranial tension, no matter what it is due to. They are seen in the ordinary case of hydrocephalus. They mean a uniform increase in intracranial pressure and they mean nothing more.

Now what have we to go on if we disregard, as I think we must, the mother's story of an injury followed by the appearance of a tumor, and if we conclude, as I think we may, that a tumor existed and was first noted because an injury caused the child to assume more than his usual prominence in the family group? We have a unilateral proptosis, an interference with the return cerebral circulation as shown by the great prominence of the veins, a tumor mass filling the left temporal fossa, and a group of glands in the neck on the same side, hard, uniform, and showing no special signs of breaking down. We are dealing with a condition that probably has been afebrile and that has caused only minor constitutional disturbances. For I think we may disregard also the story of occasional vomiting. Babies who are irregularly fed and unwisely fed, as children of this class are apt to be, would show such disturbances intermittently without the intervention of any special disease.

What are the conditions which could produce this group of symptoms and signs? We have a rather severe bulging of the left eye, a large tumor mass in the left temporal fossa, a group of enlarged glands on the left side of the neck, some intracranial pressure apparently in the region of the cerebral sinuses, and *x*-ray findings of a thinned-out skull with separation of the normal fissures. Well, first we may conclude that something is causing pressure, something is making this eye bulge out and is filling up the temporal fossa. And, what is still more significant, this seems to be a progressive condition. I would say that this child is rapidly getting worse. The history is incoherent, and I distrust that story of a slight loss of weight. I think there has been a marked loss, for the child is emaciated, pale, and anemic. Unfortunately it is impossible to examine the eyegrounds, so we cannot arrive at the condition of the optic nerve. For the first thing we would think of with this special group of symptoms is a tumor behind the eyeball, one of the retrobulbar group of neoplasms. If this is a neoplasm of that kind, it has burst through the orbital plate, for there are definite signs of pressure within the brain cavity. It has also extended sufficiently to fill up the temporal fossa, so whatever tumor has been sufficient to make the eyeball bulge forward has also caused a sufficient increase in pressure to fill up the temporal fossa.

We must find a tumor which answers certain conditions, which will explain not only the findings in the temporal region but also the findings in the neck. We must not forget that mass of enlarged glands there. What tumor will cause these conditions, plus a marked cachexia?

Certainly it must be a malignant neoplasm. And, since this is a baby only seventeen months old, it must be one of the sarcomatous group of malignant neoplasms. Since this tumor probably originates in nerve tissue, it must be a gliosarcoma, probably of retrobulbar origin, with an invasion of the brain cavity itself. This is a tumor which is rapidly growing and rapidly fatal, and we know nothing whatever to do for it. Our problem here is unfortunately merely a problem of diagnosis.

We started, as I have shown you, with nothing to go on, with a history which we could discount, with meager laboratory findings, with nothing but a physical examination on which to base our conclusions. But that physical examination showed certain definite features, that we were dealing with a tumor that was apparently infiltrative in character, that had metastatic properties, that was rapidly growing, that was causing a marked cachexia, that was pressing on the cerebral sinuses, and a consideration of these facts showed us that we could not be dealing with a benign neoplasm, that we must be dealing with a malignant growth. Well, malignant growths which occur in children of this age in this special area again are limited in number and are sarcomatous in character. Malignancy in children of this age is characterized by very rapid development. If we could follow this child to the exitus, which I do not think is very far away, I predict that we should see at the end the situation of a child attached to a tumor. The younger and more actively growing the host is, the more rapid and the more extensive is the development of the malignant process. The course is so swift as almost to suggest an acute inflammatory lesion. I have seen several young children born with kidney neoplasms, in whom the rate of growth of the neoplasm actually exceeded the rate of growth of the child, so that at the end we had the picture I have described to you, of the child growing on to the tumor.

If this condition were an abscess we should have a marked elevation of temperature, with a marked constitutional reaction. We have not those findings present and I do not think they have existed. If the condition were the result of hemorrhage, which in turn was the result of the fall, it would have showed itself more promptly. Hemorrhage does not take a month to reach its acme. The fall, as I have said, I think we can safely discount. It may have brought the tumor to the mother's notice, but it certainly did not cause it. Just on the clinical appearance, and that is all that we can safely go on, I would put this tumor down as a gliosarcoma, the exact origin of which I do not know, although I am inclined to think it is the optic nerve. The *x*-ray shows us that there is cerebral involvement, and there has undoubtedly been bone erosion.

As to therapeutics, I have nothing to say. No medicine, no surgery, no treatment of any sort will help this unfortunate baby. This is a condition before which we are perfectly helpless, and in which we can simply surrender to the inevitable.

I might add that in the recent classification of tumors of the central nervous system advanced by Harvey Cushing, this type of growth would be called a neuroblastoma or a chloroma. In calling it a gliosarcoma I have followed an older classification.

COMPRESSION FRACTURES OF THE SPINAL CORD

This patient, a white male aged twenty, presents some rather interesting problems in the diagnosis and subsequent management of a typical group of injuries. He exhibits what we commonly call a broken neck, or, more scientifically, a compression fracture of the cord, a type of injury that can lead to disabling illness and often to death. This boy does not present an entirely typical history, and he has been very fortunate in escaping the usual severe consequences that accompany this type of fracture.

January 12th he was in an automobile accident, in which he was thrown violently against the back of the seat. After several minutes of unconsciousness he recovered, and found himself unable to move his legs or arms, although there was a tingling sensation in both extremities. Within a few minutes more he was able to move his legs, but not until ten hours later could he move his arms. The tingling sensation continued and his fingers were swollen and remained so for two days. He was treated with alcohol rubs and some medication, the nature of which he does not know, and he remained in bed for a week. Pain and stiffness in the neck and shoulders have prevented his resuming his usual occupation (farming) and he finally sought hospital treatment.

The physical examination is essentially negative except that the movements of the neck are limited and forced manipulations are painful. There is an area of tenderness 4 cm. superior to and 2 cm. lateral to the spine of the last cervical vertebra. Both hands seem to be less powerful than would be expected in a man of this size and apparent vigor. There are no anesthetic areas.

x-Ray examination shows a fracture of the sixth cervical vertebra with no dislocation.

It should have been stated in the history that the patient had a short period of hematuria, but no retention at any time. (Student's history.)

This boy gives a rather unusual history, the story of an accident which usually has consequences far more serious. He has a typical fracture dislocation of one of the cervical vertebrae, or a broken neck. The degree of injury and the amount of residue are extremely variable in these cases and obey certain mechanical laws as to the direction of the force applied. Here the injury is of the sort usually seen after diving into shallow water. It is the typical broken neck of a shallow dive. The mechanics are rather simple. The water is too shallow for diving, the head is flexed, the neck is acutely flexed, and the result is a dislocation of a vertebra and possibly of an intervertebral disk, with more or less injury to the spinal cord, depending upon the amount and direction of the force. We call this injury a fracture, but the bone injury plays a rather unimportant part. The real emphasis is upon the dislocation and the resulting amount of injury to the cord itself. The extent, insofar as the bony skeleton is concerned, is of little or no significance in the light of the other damage. The injury to the cord within the canal is the important factor.

In this particular instance we are dealing with a rather mild lesion. If we were dealing with a severe one, there would be a paralysis of both arms, both legs, the trunk muscles, bowel and bladder function, etc. None of these things is present in this particular case. There is no paralysis, and, except for the hematuria, which was transient, bowel and bladder function have not been interfered with.

All fractures of this sort are classified according to the injury which caused them as due to direct and indirect violence. In the latter type the head receives the blow and transmits it indirectly to the neck, the acute flexion and the weight of the body playing their part in the causation of the fracture and dislocation of the vertebra. Often just a little chip is knocked from the body of the vertebra, which snaps immediately back into place after the dislocation, and *x*-ray an hour or two after the accident may show no trace of bony injury. But the patient may be completely paralyzed and damage to the cord is permanent. This is a typical illustration of the very severe effects of a fracture caused by indirect violence.

Fractures by direct violence are not so frequent. They include stab wounds, gunshot wounds, traumatism such as would follow the passing of a trunk over the body, let us say, and similar injuries. They are not difficult to recognize and not so hard to deal with from a diagnostic point of view.

The compression fracture of indirect violence, with spinal cord injury, is a serious thing from any point of view. We usually see them fairly early, and there is at least one outstanding feature, a flaccid paralysis of everything below the point of injury, which, unfortunately, is most often the neck. The vertebrae are weakest in this area; the laminae are thin, small, rather branched-out, and peculiarly susceptible to injury, particularly to what we call the jack-knife type of injury. The vertebrae spring back into place immediately, exactly as a knife of this sort opens and closes, but there is a permanent damage to the cord as a result of the pinching.

The location of the level of the injury is most important. If it occurs above the level of the fifth vertebra, death is a matter of a few hours. The phrenic nucleus, at the level of the fifth vertebra, or possibly as high as the lower border of the fourth, is the crux of what is going to happen. Injury above means that the patient must die, and that rather promptly, while injury below means that he may survive, and in any event, other things being equal, that he will not die immediately. If the injury occurs above the phrenic nucleus, the respiration is cut off promptly and the patient succumbs from respiratory failure.

A great deal of time and attention has been devoted to these injuries, chiefly with the idea that eventually some sort of surgical procedure may be instituted for their relief. There are two chief theories about them, one that the injury is to the cord itself, the other that the cord damage arises as a result of hemorrhage within the spinal canal. The latter theory, thanks to a very excellent study by Thompson of Galveston, may be entirely discarded. There may be occasional cases in which there are cord compressions as a result of hemorrhage, but nobody, even when surgery was in vogue for these injuries, was able to demonstrate it at any time. The whole theory is based on the analogy of subdural and epidural hemorrhages in the skull, and what surgery is able to achieve in those cases by relief of the tension. Nobody has ever demonstrated sufficient hemorrhage within the spinal canal to cause compression of the cord, and therefore laminectomy and cord decompression have fallen into disrepute because there is no real basis for them.

The real pathology, the lesion that is seen in these patients at autopsy, is a disintegration or pulpification of the cord at the site of the compression, and since this is so you may take my word for it, no matter what anybody says, that damage is permanent and complete. There is never any possibility of regeneration. Some years ago occasional cases were reported in the literature in which, after laminectomy and suture of the cord, there had been some supposed return of function. It was therefore concluded by some surgeons that regeneration had occurred, but nobody was ever able to prove it. The damage is always permanent. Dr. Thompson's comparison is not very elegant, but it illustrates perfectly what has happened. The pulpification of a banana within its peeling, without injury of the peeling itself, is an exact picture of the cord injury. The cord pulpifies, degeneration begins immediately, and subsequently the nerve cells in the spinal cord are entirely lost; there remains an irregular mass of scar tissue, with no characteristics of ganglion cells, nerve sheaths, or anything to make up the true histologic picture. There is always evidence of trauma to the cord, exactly as there is evidence of trauma elsewhere in the body. I am fond of illustrating what has happened by the analogy of the familiar black eye. Gross appearance and microscopical section show the same thing, petechial hemorrhages, extravasation of blood, and discoloration of the surrounding tissues.

Frazier of Philadelphia and some of his co-workers, particularly Temple Fay and Francis Grant, endeavored to devise some surgical procedure which would take care of this extravasation, just as decompression allows the reestablishment of circulation in the brain and takes care of cranial injuries. They finally hit upon cordotomy, laminectomy plus longitudinal sections parallel to the great nerve bundles of the cord, hoping thus to take care of the extravasation, reestablish the circulation, and allow for the products of inflammatory reaction. The theory is logical and the results theoretically should be good, but up to this time nothing at all has been accomplished.

In fractures of the spine surgeons fall into two classes—the interventionists, who consider it the proper thing to try to relieve the condition by surgery, and the noninterventionists, who believe that nothing is achieved by operative procedures and who up to this time seem to have rather the better of the argument. Some years ago I had a case of high cervical fracture from diving into shallow water, and one of the most prominent neurologists in the country was called into consultation. My own policy had been one of strict nonintervention, but he advised operation. I asked why the advice, and he replied that it was given in the hope that the patient would die promptly after intervention. For my own part, I do not care for the rôle of executioner, and I continued to withhold surgery.

A patient with a serious cervical injury gives no external evidence of his pathology other than a complete motor and sensory paralysis below the level of the damage. As to diagnosis, Queckenstedt's test gives us collateral information of what is known as a block, but is of no other aid. This boy's reaction was not positive and he never had any evidence of block. His spinal fluid manometer reading was plus 10, and pressure over the jugulars raised it to 20. You can see very well that the test was of no value here, though it is helpful in dealing with spinal tumors, in which we must determine the level of the block.

This patient has no residue of any special consequence. We are a little afraid of the possibility of dislocation and subsequent compression, and therefore we shall treat him with extension, possibly the Jury mast, until his disease can take care of itself. We want to run no risk of the tearing and laceration of the intervertebral ligaments, with consequent dislocation and compression of the cord.

If the injury is above the phrenic nucleus, as we have said, these patients will die rather promptly from respiratory failure. If it is below, they may survive for a considerable period of time, and eventually they will die of their complications; the majority of them do not die from the fracture itself. The first thing that happens, and it happens fairly soon, is continence of urine. The patient is not able to empty the bladder at all, and the temptation is to catheterize him, to do a suprapubic cystostomy, to intervene in some way. But a rather large experience with cord injuries during the war soon taught us that this was the worst possible thing to do. No healthy bladder has ever been known to rupture from overdistention, and none ever will. If you let the patient alone, when the bladder has reached a certain degree of distention, it will overflow and keep itself sufficiently empty to prevent any accident. Furthermore, complete motor and sensory paralysis such as we have in these cases means complete absence of pain, and that factor need not be considered in our policy of inaction. The moment you manipulate a bladder in any way you introduce the element of extraneous infection and the patient succumbs to it promptly. As to the rectal paralysis, the sympathetic nervous system takes care of that up to a certain point, and enemata, flushes and irrigations do the rest.

Next, these patients invariably develop bedsores of the type we classify as trophic ulcers. They do not heal, they tend to slough, and, because of lack of resistance, they tend to spread, the patient often dying from sepsis from the absorption from them. The ulcers develop wherever there is pressure, and develop first, therefore, on the prominences of the body. Sometimes ulcers on the buttocks and the shoulder-blades coalesce, so that the back is simply an area of ulceration. All sorts of beds and mattresses, chiefly of the air and water types, have been devised to meet the situation, but none of them has been very successful.

The most interesting feature in these cases is that the gross evidence of injury is out of all proportion to the actual amount of damage. This is due to the normal resiliency of the vertebrae, which, unless they are actually crushed, spring back to their places as does a jack-knife, though before this happens the cord has been sufficiently damaged by compression or actual pinching to set up a process of degeneration which begins instantaneously and which does not permit of regeneration. The local condition in the cord is characteristic of trauma anywhere else in the body.

The accumulated experience of the profession today is that surgery is of no great value in these cases, certainly not of sufficient value to warrant its performance except under very exceptional circumstances. Unless we have a reasonable suspicion that the injury is due to gradually increasing pressure, there is no justification for interference. The only thing that can give us that picture is hemorrhage, with a gradual accumulation of blood within the canal, and I have already pointed out to you that there is no authentic basis for that suspicion. It follows, then, that there is no basis for surgery. If that situation did come to pass, the progress of the pathology would be gradual because the compression would be gradual, whereas in these cases the symptoms are always simultaneous with the injury. From the time it occurs the patient is paralyzed, and we have every reason to believe that the complete division of the cord occurs then.

This patient illustrates the type of case in which there has been a slight degree of trauma which has not been sufficiently strong completely to sever or pulpify the cord in the canal, and he is a most fortunate young man. He is going to recover, I think completely, because of the law of physics which explains the direction of the applied force which caused his injury. It is just opposite to what we usually see. We usually see the weight of the body directed upon the head, whereas he bumped his head, but not with sufficient force to do much damage, thanks to the fact that the weight of the body was not the factor it usually is.

Finally, the care of these patients is largely a matter of nursing, and when they succumb, as most of them do finally, it is not to the injury itself, but to sepsis due to infection from the bladder or from the bedsores they invariably and inevitably develop.

GAS BACILLUS INFECTION

The body is that of a white male of twenty-six, whose previous history is irrelevant. He died of gas bacillus infection, and I feel decidedly apologetic about his death, for to some extent it was my personal responsibility, in that I failed to recognize a condition which I thought I knew very well.

The sequence of events is briefly this: During the cold spell just before Christmas he hunted ducks in the swamps, and for many hours, in a snowstorm, walked about in cold, muddy water. Typical frostbite followed, with gangrene of the feet. It was a definite gangrene, with characteristic cyanosis in the early stages, and it extended to the middle of the feet. For two days after he entered the hospital he was kept under observation and treated with dry hot air, and during this time there was a progressive blackening of the affected area.

I shall pause here to point out that once gangrene has become established, this sort of treatment is justified, but that it is the worst possible treatment in the early stages of frostbite. Then the thawing must be done gradually, to allow the circulation to become reestablished, and the application of heat introduces the danger of thrombosis. The lay treatment, rubbing with snow, has a correct basis of fact, though the persons who apply it probably do not know it.

I believe this unfortunate man had been treated by heat originally. At any rate, when we saw him several days after his exposure, the gangrene was already in evidence. The idea of our treatment during the period of observation was to limit the infection and to wait for the line of demarcation to establish itself, so that we might do a conservative amputation. This line of demarcation can best be described as the line of ulceration which separates the living from the dead tissues; if the patient survives without surgical interference, the dead or gangrenous tissues are cast off at the line of ulceration. Usually, however, sepsis prevents this spontaneous termination and surgical aid is indicated.

Now in this case we believed that we were dealing, as we usually are in such cases, with an ordinary saprophytic infection, and the laboratory report on December 29th was negative for anaerobic organisms. The following day the patient seemed increasingly septic, so immediate double amputation was done below the knee, well above the area of involvement. Within two days he developed a very high fever and began to exhibit a characteristic foul, putrid odor, the typical "rotten meat" smell of gas gangrene. Dr. Garside, on my instructions, immediately repeated the amputation on one leg, well above the area of putrefaction, and opened the other leg wide in an endeavor to overcome the infection. Repeated cultures this time were positive for anaerobes, and death ensued shortly.

From the clinical standpoint this case presents several unusual features. In the first place, in a rather long experience I have never before seen frostbite in the South, though I have no doubt that it occasionally occurs. In the second place, there was no evidence at the time of the first operation of gas bacillus infection. The tissues seemed in fairly good condition, bleeding was quite free, there was no muscular edema, no characteristic khaki color, and the man seemed a fit subject for amputation below the knee. In spite of this, gas bacillus infection was apparent later, and it must have been present and been overlooked then. In the third place, it is rather unusual to see this type of infection develop in any but muscular tissue. Contaminated muscle is always a potential site for it. I had a very fair experience with it during the war, when it was responsible for a large number of our fatalities, and most of the cases were in wounds of the calf of the leg or the muscles of the thigh. This is an organism which cannot live without sugar and which thrives best on muscle sugar. Finally, limitation of the vascular supply is a predisposing factor to some extent, because the large amount of oxygen in the blood stream plays some part in inhibiting the growth of the organism.

This man died with rather characteristic findings, high fever and almost complete shock. The muscle decomposition which occurs as the result of the invasion of micro-organisms results in the throwing off of foreign proteids as well as of a specific toxin, which is very fatal and which especially affects the myocardium. In the few patients I have seen who have recovered from this infection, there have been evidences of myocardial infection for long periods afterwards. In this instance, if we had had the cultures earlier, an immediate high amputation might have saved the patient, but the negative pathologic report and our own lack of clinical observation threw us off. The fact that there was no evidence of crepitation in the tissues is no excuse for us; if we have to wait for that sign to develop before we make a diagnosis of gas gangrene, we are just a little late on our jobs. In former days we waited to diagnosticate the condition until patients were moribund and the gas bacillus generated gas, but there is no excuse for that today. Indeed, I believe it would be well to get away from the term "gas" bacillus, because the inference that there must be gas is likely to mislead us and make us delay until it is too late to accomplish anything.

There are certain characteristic early signs and certain wounds in which we should be on the alert to suspect this condition. Deep muscle wounds with contamination are potentially infected by this organism, and the characteristic look or smell will complete the diagnosis. There is no need to wait for cultures; unless diagnosis and treatment are equally prompt, the patient cannot be saved. The cultures, by the way, are characteristic. Litmus milk is used, under anaerobic conditions, and gas bubbles appear in it very promptly.

The clinical picture is likewise typical. Almost as soon as the infection begins, the patient goes into a state of surgical shock, with high fever, fast pulse, perspiration in spite of the hyperpyrexia, and a tremendous degree of prostration. Also the local odor and the khaki color of the skin (due to anemia) are characteristic. The spread of the infection is unusual. It invades groups of muscles, as I have said, and just ahead of the affected groups are intramuscular planes filled with serous edema.

The organisms follow the edema across the joint lines and invade successive groups of muscles in orderly progression. Meantime the patient has developed a septicemia, which is almost invariably fatal.

There are four or five outstanding gas bacillus organisms, although many times that number have been isolated at the Pasteur Institute. They include the Bacillus welchii—this was formerly the generic name for the whole group, but now it is recognized as simply one of the commonest—the B. perfringens, the B. edematiens, the B. saprophyticus, and the vibrione septique. The question of antitoxins naturally comes up here, and we are in exactly the same situation as we are in regard to the streptococcus. If we could get a pure strain, as in erysipelas, for example, then we could hope for results. But this does not happen. In any given case we may have one outstanding strain, but we have possibly four, possibly forty others associated with it. Antitoxin will kill one strain, but it will not affect the others, for the infection is due not to a single organism, but to a whole group of anaerobes.

In the early days of the war the pure Welchii strain was isolated at the Rockefeller Institute, and I saw most interesting experiments carried on. Dr. Bull, who was just back from France, perfected a serum which was a specific antitoxin for this special strain. It was even more potent than the diphtheria antitoxin is. Pigeons were infected experimentally, the muscles of the breast were allowed to reach a point of absolute necrosis, and when the birds were actually moribund, the serum was given with completely curative results. Our hopes were high that the remedy had been found for gas infection, then rampant in France and the cause of the highest mortality after hemorrhage and shock. But its use was absolutely futile. Similar disappointments awaited us with the polyvalent, or rather the bivalent serum against the B. welchii and the B. perfringens, and we eventually learned the reason, that we are dealing with many mixed strains and not one or two.

The most characteristic postmortem finding is the foamy liver, and it is missing in this case because the liver has been totally destroyed by postmortem changes. All of the other organs exhibited more or less crepitation at autopsy.

The most interesting local work in this condition has been done on my service by Dr. I. M. Gage, and in a paper in the American Journal of Surgery in 1927 he reports 4 or 5 cases which recovered because the diagnosis was made early and treatment instituted early. Dr. Gage began his investigations with a single observation we had made, that gas bacillus infection does not occur in the summer, at least in New Orleans. Tracing this down, he found that injuries which occurred in the winter had always occurred through woolen clothing, whereas in summer this was not the case, for in this climate people seldom wear woolen garments then. He secured samples of woolen material from various factories and stores, washed them and cultured them, and in every instance he identified the spores of anaerobic organisms. He therefore had two predisposing factors for the production of this infection, muscle injury and injury through woolen clothing.

His observations were corroborated by clinical observations, which I think are worth repeating. One man, sleeping without sheets between blankets, was given a hypodermic and developed a gas bacillus infection at the site of his injection. Another man, also sleeping between blankets and without sheets, was badly burned and developed a gas bacillus infection in the burned areas. A third patient with diabetic gangrene, the ordinary gangrene of his condition, was being observed for the formation of his line of demarcation, and during the period of ulcer formation wrapped the affected foot in blankets to keep it warm; he developed a gas bacillus infection on top of his diabetic gangrene.

Now all of this is more than coincidence. The explanation is that the gas bacillus is a spore-bearing organism. The normal habitat of the spores is the gastro-intestinal tract of domestic animals, especially sheep, and sheep's wool is always contaminated. Sheep are not clean animals. They sleep in stables, they wallow in the excreta of the intestinal tract, their wool is invaded by spores, and Dr. Gage's investigations prove conclusively that in spite of the processes which their wool goes through, from shearing to weaving and dyeing, the spores are still present. And this particular spore is the most tenacious of them all. Simple boiling does not kill it. Sterilization in the autoclave, repeated boiling, or boiling over a long period of time is necessary to destroy it.

The process of invasion I have already described, but I might add that the toxin which is isolated from the organism will cause muscle necrosis and give the same reaction as the organism itself. The clinico-pathologic side is beyond dispute. On the purely clinical side, investigations into the subject have led to a revolution in the treatment of wounds and this change is the one epoch-making thing which came out of the war. Débridement or mechanical sterilization is now the accepted treatment of wounds; if this is not practical, then sterilization must be brought about by specific agents. And these agents are not mercurochrome and iodine. They have pleasing colors, particularly the former, but they do not inhibit the growth of spore-bearing organisms. The gas bacillus is an enduring and a deeply entrenched organism, and the strongest and most caustic antiseptics are necessary to search it out.

Tetanus is apparently less prevalent today, due to the use of antitetanic serum, but the gas bacillus type of infection is apparently more common, or perhaps it is being more steadily recognized, I cannot say which. I think the reason we see so much of it in my service is because we are always watching for it, and since this is so, I am particularly humiliated that we allowed this case to escape us, chiefly because we relied on the laboratory and were misled by a wrong report.

The disease in this special instance began with what in the war we called "trench foot." It comes from walking around in cold, muddy water for a long period of time, and infected water at that. The man was too young for there to have been the possibility of vascular disease. The sequence of events is perfectly clear.

After amputation, when his condition was recognized, he received the antitoxin, but it did no good. It was given intravenously. I have never been an advocate of the intraspinal or intraneural use of sera for any disease. In tetanus, for instance, the antitoxin is valuable only against newly produced toxins. When the disease manifests itself clinically, the toxins are already in the central nervous system and have formed a combination with the cells of the anterior great horn of the spinal cord which it is impossible to break down. All that the antitoxin does is to prevent more poisons being thrown out into the circulation, it cannot affect the combination which has already been formed, and it is that combination which finally kills the patient. The antitoxin is a valuable prophylactic, but it is not curative and should not be so regarded. Now the Bacillus welchii soluble toxin antitoxin is quite different; it is absolutely curative. I have already explained to you, however, that it cures only single strains, and that its clinical use is therefore an empirical performance.

The duration of the disease depends on many factors, the primary infection, the personal resistance of the patient, and the point of injury. I recall one patient who recovered after a local gas bacillus abscess by simple drainage. Once or twice I have dissected out a whole muscle group, such as the quadriceps extensor, with good results. But if you will recollect my description of the spread of the infection, you will see why I say that the progress of the disease cannot be foretold. In wounds of the calf, there is an extension to the knee joint, then a temporary stoppage, because practically no muscles cross the knee except, if I remember my anatomy, a very small one in the popliteal space. Amputation at that time at a point above the point of infection may result in a cure. After the infection crosses the knee it will stop again at the thigh before invading the abdomen, and again an amputation higher up may check it. In the upper extremities, however, nothing will stop it because the shoulder is literally wrapped up in muscles. Progress to the chest muscles, the pectorals, is therefore swift and easy, and death occurs promptly.

I have been challenged for the statement, though I still stick to it, that I have seen many patients recover after an amputation of the lower extremities for gas gangrene, but I have never seen one recover after an amputation of the upper extremities. The explanation is simple, the profusion of muscle tissue at the shoulder joint, the lack of it at the knee. I never amputate an arm for this condition. The patients reported by Dr. Gage, all from my service, recovered after wide slashing of the arm tissues, with the proper application of antiseptics, the most valuable of them being permanganate of potash, which is an oxidizing agent. I do not believe in injections of peroxide of hydrogen into the tissues; patients get well in spite of this treatment, not because of it. Any patient who survives a gas bacillus infection also survives a mild septicemia, which starts almost simultaneously with the local infection. Oxygen stays in the tissues just a few moments, spores live for years, so the futility of the treatment is apparent. The only successful treatment is by amputation ahead of the infection, or by the relief of tension in the tissues by free slashing, which, with local drainage, permits a reestablishment of the circulation.

CLINIC OF DR. STUART McGUIRE

McGuire Clinic, Richmond, Virginia

MEDICAL VS. SURGICAL TREATMENT OF DUODENAL ULCER

The first question in a case of ulcer of the duodenum is whether the treatment shall be medical or surgical. Shall the patient be given the medical treatment standardized by Sippy, which consists essentially of rest in bed, a restricted diet, and the neutralization of the stomach contents by the administration of alkalies, or shall the abdomen be opened by the surgeon and the ulcer excised or a posterior gastro-enterostomy performed? On this question there has in the past raged a vigorous and almost disgraceful controversy. It was due to the fact that physicians generally treated patients in the early stages of the disease and saw them relieved of their symptoms and apparently restored to health. They were usually ignorant of the relapses that occurred. Surgeons, on the other hand, dealt with patients who had suffered with duodenal ulcer for years and had been treated by many physicians without permanent relief. They were therefore impressed with medical failures and unmindful of medical cures.

Out of this discussion the profession has finally come to the conclusion that certain cases should be treated medically and other cases should be treated surgically, and the indications and the contra-indications for the respective methods of treatment have been pretty well crystallized.

It is now generally accepted that a duodenal ulcer, unless it produces marked pyloric obstruction or is shown by the *x*-ray to be of the perforating type, should be treated medically, provided the cooperation of the patient can be assured. So great is my belief in the efficiency of medical treatment in properly selected cases, and in the better results secured in the cases cured medically compared with those cured surgically, that when operating on a patient who has both duodenal ulcer and chronic appendicitis I often remove the appendix and leave the ulcer to be treated by my medical colleagues.

Success in the medical treatment of an ulcer depends not only on the nature of the lesion but also on the temperament, intelligence and financial means of the patient. There is a peculiar psychology of the sick which often makes a patient, who would be perfectly willing to stay in a hospital if he were operated on by a surgeon, unwilling to stay the same length of time to be cured of the same disease by medical treatment at the hands of a physician. If the patient is of a rebellious temperament and at the outset refuses to enter the hospital and insists on carrying out the treatment at his home, there is no use undertaking the case. Again if the patient has scant intelligence, and lacks the control necessary to cut out the desires of his appetite he had better be turned over to the surgeon to cut out his ulcer. Finally if the patient's financial means are such that he has to do hard manual labor to earn a living, and has to subsist on coarse and improperly cooked food, the prospects of a cure by rest, diet, and medication over a long period of time are not good. The medical treatment of duodenal ulcer is poor treatment for poor people.

When after a careful study of the character of the ulcer and the attitude and circumstances of the patient, it is decided that the case is a suitable one for medical treatment, the first thing to do is to have a frank talk with the man. He should be told exactly what will be expected of him. He should be told that he will be required to stay between three and four weeks in the hospital and another two weeks at home before he resumes full work. He should be told that the diet and frequent feeding and medication will have to be continued over a period of months, possibly a year or longer. The necessity of following the régime without modification should be stressed and the principles underlying the treatment should be fully explained. With such an understanding at the outset it is usually not difficult to obtain complete cooperation during the months that follow and the results are usually most satisfactory.

The advantages of the medical treatment of an ulcer of the duodenum over the surgical treatment are not only that the danger and painful ordeal of an operation are avoided, but that the anatomical structure and physiologic function of the stomach and duodenum are not distorted or perverted. It is true that sometimes after a cure has apparently been effected there is a recurrence of symptoms, or even a hemorrhage or a perforation, but these calamities are the exception and not the rule, and they are no more frequent than the complications which sometimes follow surgical operations in the form of the vicious circle, or regurgitation of bile, the dumping stomach or too rapid passage of food into the intestines, and the secondary ulcers which form in the new pylorus or at the anastomotic opening into the jejunum.

The indications for a surgical operation on a patient with duodenal ulcer are: (1) Hemorrhage; (2) perforation; (3) persistence or recurrence of symptoms despite painstaking and prolonged medical treatment.

In cases of hemorrhage an immediate operation is rarely advisable. The vast majority of patients will have a better chance for life if they are first treated by absolute rest, the prohibition of food, the administration of horse serum, or transfusion with blood. After bleeding ceases, and the general condition improves, an operation should be done to prevent the recurrence of the symptom. In these cases it is not sufficient to do a gastroenterostomy even with infolding of the ulcer. To prevent further bleeding it is necessary to either excise the ulcer or destroy it with an actual cautery.

In cases of perforation an operation should be done as soon as a diagnosis is made. The recognition of the condition is based on the history of previous symptoms of ulcer, although, strange to say they are often lacking, on the sudden agonizing pain which is not relieved by the ordinary doses of morphia, and on the prompt development of boardlike rigidity of the abdominal wall. When there is a question as to whether the case is one of fulminating appendicitis or perforating ulcer, the abdomen should be opened by a midright rectus incision which can be extended up or down to meet conditions. If a perforation is found, no effort should be made to excise the ulcer or freshen its margins, but the opening should simply be closed by purse string or interrupted chromic catgut sutures and the area protected by covering it with a piece of adjacent omentum. If this perforation constricts the outlet of the stomach the operation should be augmented by a posterior gastro-enterostomy. Some surgeons advise this as a routine procedure, but in my personal work I have rarely deemed it wise or necessary. After dealing with the perforation the free fluid in the abdomen should be removed with sponges or a suction apparatus, and the area around the site of the operation drained with folded sheets of rubber tissue brought out through the upper angle of the wound. Irrigation of the abdominal cavity and pelvic drainage through a stab wound above the pubes have been tried, but have been found to do more harm than good.

The result of operations for perforating duodenal ulcers has been surprisingly good. Most cases recover and have no further untoward symptoms. A careful analysis of a large number of cases shows that the mortality is in direct proportion to the time which elapses between the perforation and the operation.

In cases of duodenal ulcer where medical treatment has failed surgical treatment is indicated to relieve symptoms and restore health. These instances will become rarer if surgeons when called in consultation in early cases would unite with the physician in urging the patient to carry out medical treatment faithfully over a long period of time. When medical treatment has apparently failed it will be well to ascertain just what method was prescribed, how long it was carried out, and to what extent the patient cooperated with his physician. Often it will be found that the treatment consisted only of moderate dietary restriction over a period of a few weeks, again the treatment may have been adequate, but was discontinued shortly after symptoms subsided, and finally the patient may have been unwilling to deny his appetite or to carry out the tedious schedule that was outlined for him. These cases cannot be fairly classed as medical failures, and treatment should be begun anew.

There are cases, however, where owing to failure of early diagnosis or lack of proper treatment the ulcer has become deeply indurated or the ulcerative process has resulted in cicatricial contractions that have caused obstruction of the pylorus or even dilatation of the stomach. These are mechanical conditions and can only be corrected by surgery.

In rare cases there may be an indurated ulcer which can be excised and the incision closed in such a manner as to avoid obstruction of the duodenum. This can only be done where there is a single small ulcer located on the anterior wall of the duodenum at some distance from the pylorus.

Usually the surgeon has to choose between some form of pyloroplasty or gastro-enterostomy. The operation of pyloroplasty was introduced by Mikulicz and consists in dividing the pylorus by an incision in the horizontal axis of the gut and suturing the incision at right angles to the line in which it was made. This permits the excision of the ulcer and overcomes any obstruction at the pylorus by enlarging the outlet of the stomach. Finney adopted the principle of Mikulicz, but in his operation divides the pylorus by a horseshoe-shape incision, one arm extending down the duodenum and the other along the greater curvature of the stomach. Horsley and Judd have each recently perfected very simple and safe methods of doing pyloroplasty and the technic of one or the other is generally practised by the surgeon of today.

The operation of pyloroplasty can only be satisfactorily performed for duodenal ulcer when the lesion is located near the pylorus and when the adjacent bowel wall is comparatively normal. If the ulcer is more than $\frac{3}{4}$ inch from the pylorus it cannot be excised, and if the tissues are thick and inelastic they cannot be approximated in the desired position without producing deformity and they cannot be sutured without danger of leakage.

The advantages claimed for pyloroplasty are that it places the outlet of the stomach in its anatomical and physiologic position, that it enables the surgeon to excise the ulcer area, and that patients do not suffer afterwards from the vomiting due to regurgitation of bile.

The disadvantages of pyloroplasty are that the incision is made through septic and ulcerating tissues which may cause local or general infection, that the incision is made through scar tissue which may contract and cause obstruction, that the incision is so located that it may become adherent to the liver or abdominal wall and cause interference with the movements of the stomach, and finally that secondary ulcers may develop along the suture line.

The operation of posterior gastro-enterostomy for duodenal ulcer consists in an effort to sidetrack the diseased area by making an anastomosis between the stomach and jejunum. The method is applicable practically in all cases. It is easy and safe in execution because the tissues in the field of operation are normal. Its effect on the stomach is both mechanical and chemical. Mechanically it permits the gastric contents to pass readily into the intestines, as the new opening between the stomach and jejunum relieves any obstruction that may have existed at the pylorus. Chemically it lowers the acidity of the gastric contents, as the stoma also permits the alkaline secretions of the liver and pancreas to pass into the stomach. Thus, gastric dilatation and food stagnation are cured by drainage, and the hyperacidity of the stomach is relieved by neutralization of the acid with the patient's own alkali.

The objections offered to the operation of gastro-enterostomy are that sometimes food escapes too quickly from the stomach, causing bowel disturbances, that occasionally bile and pancreatic secretion enter the stomach in large quantities, causing nausea and vomiting or the so-called "vicious circle," and finally, that in a few cases an ulcer develops in the jejunum, at or near the anastomosis, due to the irritation of a mucous surface which has no natural immunity to the action of gastric juices. This complication can be made infrequent by placing the opening at the bottom of the stomach so there will be no retention, and by using catgut instead of silk so there will be no unabsorbable sutures left as a possible source of irritation.

The operations of pyloroplasty and gastro-enterostomy each have their advantages and disadvantages, both have their special field of usefulness and neither should be employed to the exclusion of the other.

Unfortunately certain surgeons in their advocacy of one of the two methods have been harsh in their cirticism of the other, and a controversial spirit has developed that has resulted in an unjust disparagement of all surgery for duodenal ulcer.

The present trend of surgical practice is in favor of pyloroplasty, but as has previously been pointed out the operation has only a limited field of application. At the Mayo Clinic during the year 1929 seven hundred and forty-six operations were done for duodenal ulcer, and of these operations a posterior gastro-enterostomy was performed more than twice as often as all other methods combined.

Personally, I know of no operation in surgery, with the exception of partial thyroidectomy for exophthalmic goiter, that gives such prompt and satisfactory results as a well-executed posterior gastro-enterostomy on a properly selected case of duodenal ulcer. Conscientious surgeons claim that the operation gives complete and permanent relief in 90 per cent of patients and admit that most of their failures are due to faulty technic in the operation or lack of judgment in its application.

Dr. Wm. J. Mayo, with the cooperation of the Metropolitan Life Insurance Company, has made a follow-up study of several thousand patients who had been operated on for duodenal ulcer, and he found that these individuals lived longer than the average expectancy of life of people of the same age who had not been operated on. The same was not true, however, of patients with gastric ulcer.

CLINIC OF DR. CARRINGTON WILLIAMS

McGuire Clinic, Richmond, Va.

CONGENITAL DEFECTS OF THE ANTERIOR ABDOMINAL WALL

REPORT OF CASES

Case I. Amniotic Hernia.—Baby W., negro, female, aged two days, was admitted to St. Philip Hospital on September 24, 1929. The baby had been delivered from a normal mother after a normal labor at full term. The mother had one other child two years of age perfectly normal. The baby was well developed and nourished, took feedings vigorously and passed normal stools and urine. The anterior abdominal wall was absent, the abdominal contents being covered by a transparent membrane through which the intestinal coils could be clearly seen. This defect was about 3 inches in diameter and on its lower portion the stump of the umbilical cord was attached. At its edge it was continuous with skin which was thinned over it. There was no protrusion of the abdominal contents (Fig. 303).

The rectal temperature remained normal for forty-eight hours, but on the morning of operation (September 26, 1929) it was 100.6 F. When the baby arrived in the operating room it was noted that the transparent membrane had become yellow and opaque, there was obviously some infection but closure of the defect was imperative. Ether anesthesia was used. It appeared impossible to dissect the skin from the membrane without opening the abdominal cavity, so an incision was made about $\frac{1}{4}$ inch from the skin edge, leaving this small circle of skin attached. The skin was undermined for about 2 inches around the whole defect without disturbing the muscles, the excessive stump of the umbilical cord was removed and the skin easily closed down the midline with interrupted sutures.

The baby rapidly declined and died twelve hours after operation.

The report of postmortem examination by Dr. Pusch is as follows:

"Full length 52.7 cm. Weight 3120 Gm. Abdomen presented a midline surgical incision 11 cm. long closed by sutures enclosing a rubber drain. The incision extended through the skin and subcutaneous fascia. On removing the sutures the edges of the skin spread apart, revealing a smooth semitransparent membrane 10 cm. long and 6 cm. wide, bordered laterally by abdominal muscles, forming the abdominal wall in the midline. It presented the stump of an umbilical cord tied with catgut sutures. The skin and subcutaneous fascia had been separated as a sheet from underlying structures for a distance of 4½ cm. on either side to enable the edges of the skin being brought together in the midline. A flattened cavity 4 cm. in diameter within

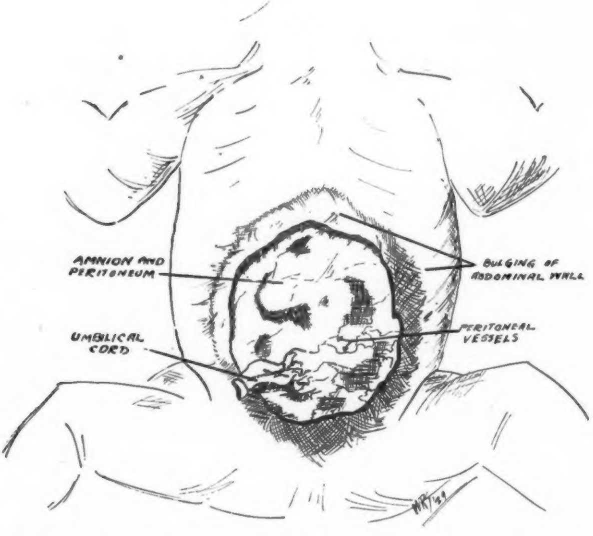


Fig. 303.—Diagram of the defect of the anterior abdominal wall, Case I.

the substance of the membrane, about the site of the umbilicus, contained pus.

"Within the peritoneal cavity intestinal coils presented numerous ecchymoses and were partly covered by fibrinopurulent adhesion. The cecum, appendix, ascending colon, and right half of the transverse colon, without a mesocolon normally attached to the abdominal wall, swung on a mesentery continuous with that of the ileum. Descending colon, sigmoid, and rectum were normally attached. The liver, with a normal weight of 120 Gm. was abnormal in shape, the left half was more or less globular with a blunt anterior margin. The umbilical vein entered the liver near its left border. Kidneys, adrenals, spleen, pancreas, stomach, ureters, bladder, and reproductive organs grossly normal. A Meckel's diverticulum was not present. Patency of the urachus could not be determined.

"Thorax: Ecchymoses occurred on visceral pericardium with a small amount of fibrinopurulent exudate in the pericardial cavity. The heart otherwise was grossly normal throughout with patent foramen ovale and ductus arteriosus. The lungs, not atelectatic, had cut surfaces diffusely grayish brown and moist. Thymus and aorta grossly normal.

"Gram-positive encapsulated diplococci occurred in smears of exudates from abscess of abdominal wall (membrane), peritoneal cavity and pericardial cavity."

Comment.—This defect is described by Cullen in his book "The Umbilicus and Its Diseases" as amniotic hernia. The cases reported have all had protrusion of the abdominal contents. The condition results from a failure of cleavage of the mesodermal and epidermal structures over the celom, due usually to some intra-abdominal enlargement or abnormality, but in this case there is no apparent reason for the failure and all of the muscles were present. The covering membrane is amnion or amnion and peritoneum.

Operative closure is necessary to protect the abdominal contents and should be carried out as soon as possible after birth. The fatal termination in this case from infection might have been avoided if the operation had been done earlier.

Case II. Hernia Into the Umbilical Cord.—Baby Y, negro, male, aged six days, was admitted to St. Philip Hospital on November 24, 1929. The baby appeared normal except for the large mass in the umbilical cord, but was poorly nourished. The stump of the umbilical cord measured 3 x $2\frac{1}{2}$ inches, it was necrotic in spots, bile stained, and from the distal portion there was a fecal discharge (Figs. 304, 305).

Operation was done on November 26, 1929, using ether anesthesia. An elliptical incision was made around the umbilicus and the peritoneal cavity opened. Numerous coils of small bowel were adherent in the sac and to each other by recent fibrinous adhesions and the peritoneum was deeply congested and edematous. At the distal end of the sac a Meckel's diverticulum was present which opened through the wall of the mass. The adhesions were easily separated, the diverticulum amputated, and its defect closed transversely to the lumen of the bowel, and the coils reduced into the peritoneal cavity. The umbilical defect was closed by overlapping the abdominal wall.

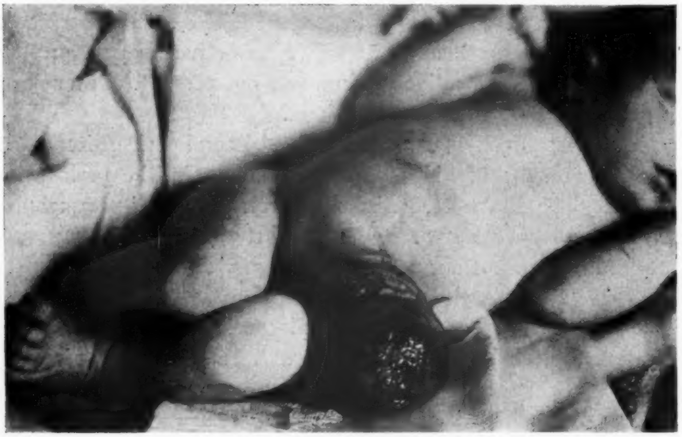


Fig. 304.—Photograph of Case II.

The baby made a good recovery, took its feedings well, and the bowels moved normally. At no time was there any great distention of the abdomen. On the eighth postoperative day it developed a thrush infection, but seemed well on the way to recovery when the parents against advice removed him from the hospital on the twelfth postoperative day. At this time the wound was entirely healed and the abdomen was flat and soft. We were informed by his physician that he died five days later apparently of inanition.

Comment.—The small bowel is developed in embryonic life in the exocelom located in the body-stalk and umbilical cord, and continuous with the celom or abdominal cavity (Cullen). When the embryo reaches a length of 4.5 cm. about the end of the second month the intestine recedes into the abdominal cavity. In this case a persistent Meckel's diverticulum which was adherent to the wall of the cavity was evidently responsible for the small bowel remaining in the cavity. Operation as soon as possible after birth is necessary to relieve this hernia because the wall of the sac is made up only of the umbilical cord and will soon slough. The infection of the peritoneum seen in the sac in this case, while it had no influence on the ultimate fatal termination, would soon have been sufficient to cause death.

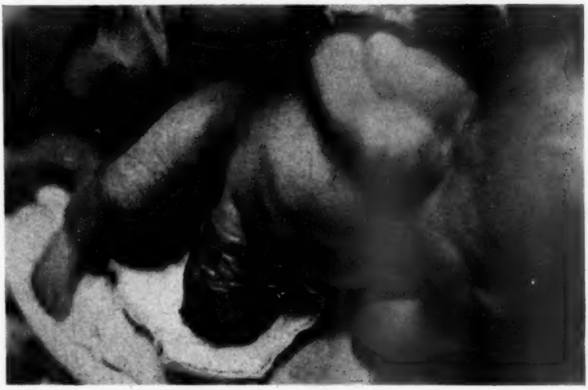


Fig. 305.—Photograph of Case II.

CLINIC OF DR. W. LOWNDES PEPLE

McGuire Clinic, Richmond, Va.

ARTERIOVENOUS FISTULA

Arteriovenous fistula, the direct communication between an artery and a vein, has long been recognized as a clinical entity. Its causes, its symptoms, its course, its tendency to develop an aneurysmal sac have all been carefully noted; but the remote effects, the crippling of the heart and great vessels, have only of late been clearly understood and properly interpreted. It is easy to understand the mechanism involved in the formation of an arteriovenous fistula. A bullet, a fragment of steel, an ice pick, or a knife blade strikes an artery and vein in close proximity, tearing them open. The high positive pressure in the artery causes the blood to pour out of the rent; the muscles and fascia closing tend to hold it within the confines of the part or limb; the negative pressure in the vein offers a ready avenue of escape; and soon the blood is rushing back to the heart by the new short route. Reparative processes are quickly mustered in, and the artery and vein are soon welded together with a fistula of varying size definitely established.

To bring the subject concretely before us, let us disregard the circoid aneurysm, certain nevi, and other borderland types and consider the typical traumatic variety. In citing the following illustrative case by noting the cause, the immediate symptoms, the course, and the late or remote results in a specific case we can more clearly visualize the clinical picture than by considering the subject in the abstract.

Mr. C. W. C., white male, aged twenty-one, 5 feet 9 inches tall, weighs 142 pounds. He is of a rather athletic type, and is strong and wiry. There is nothing in his own personal history nor that of his family that has any bearing on his present trouble.

Ten years ago he was accidentally shot through the right thigh at close range with a 22-calibre rifle, the bullet entering the inner surface of the thigh near the apex of Scarpa's triangle and passing out on the outer and posterior surface at about the same level. There was very little bleeding or swelling, and the wounds healed quickly, confining him to bed only four days. There was quite a little stiffness in the thigh when he first began to walk. When the bandages came off he noted a peculiar thrill when his hand was laid over the wound of entrance. It occupied a space about the size of a silver dollar. When the swelling and stiffness disappeared he resumed his usual occupation and sports and thought no more about it. He worked on the farm, rode horseback, hunted, and played baseball without any inconvenience whatever.

He thinks there was no increase in the area of the thrill until about a year before coming to the hospital. He first noticed that the area over which it could be felt was moving upward and downward several inches until it was within a hand's breath of the groin. It was about this time that he noticed that severe exertion would cause palpitation and heavy beating of his heart, and that he would be short of breath. For six months before coming he had at times attacks of pain about the apex of his heart, which he thought were due to indigestion. None of his symptoms stopped him from work or recreation. He was teaching tobacco curing in Canada when his first real trouble began. This was about six weeks prior to admission, when he was taken with a severe pain in the lower right quadrant of the abdomen and upper portion of the thigh. This lasted several days and left him with the thrill well up in the groin and a heavy bounding femoral pulse that could be seen as well as felt.

After an interval of a month he had a second spell of pain so severe that a physician pronounced it appendicitis and advised his going to a hospital. Instead, he came home where the true nature of the condition was recognized.

He was admitted to St. Luke's Hospital October 24, 1928, entirely free from pain or tenderness. There was a pronounced vibrant thrill plainly felt along the femoral tract from the knee to the groin. The common femoral was very large and prominent. The pulse was full, forceful, and bounding. The greatly enlarged vessel could be plainly seen and felt above Poupart's ligament. At a point just beneath the bullet wound of entry the maximum thrill was felt and here it was also most audible. It was a very loud whistling or whirring sound. It was transmitted below to the popliteal region and above to the external iliac. The character of the pulse was shocklike. The right leg was but slightly larger than the left, and there were no varicose veins visible or palpable. Though the femoral artery was large and could be easily seen and felt, one did not see or feel the dilated femoral vein that should have accompanied it. The capillary circulation of both legs and feet seemed equal. The dorsalis pedis and the posterior tibial could be easily and clearly felt in both feet and seemed normal and equal.

Intradermal saline injections in both legs showed wheals after fifty minutes, indicating equal and normal absorption.

The blood pressure in the right arm was 120/40, with a pulse rate of 75. When pressure was made above the aneurysm there was an immediate rise of the blood pressure to 135/70, and a drop in the pulse rate to 60. This drop in the pulse rate—Branham's bradycardia—was constant and immediate. Blood pressure in the right leg just above the popliteal space was 300+/20. At the same level on the left leg it was 150/80.

x-Ray examination of the heart was reported as follows: The cardiothoracic ratio is $6\frac{1}{4}$ x $11\frac{1}{4}$ inches. Fluoroscopic examination shows a rather forceful heart beat. The shadow of the aorta is normal, and the action of the diaphragm is normal. Conclusion: Patient has a rather marked enlargement of the heart, probably resulting from an arteriovenous aneurysm.

Operation—October 29, 1928. A longitudinal incision about 10 inches long was made, beginning a little below the base of Scarpa's triangle and going well down below its apex, its center being the wound of entrance of the bullet and also the area of the loudest bruit. The muscles were separated and the artery and vein quickly exposed. The wound in the artery could readily be located by a bulbous appearance and a sudden marked narrowing of its lumen. Above this point the artery was almost ½ inch in diameter, while below it narrowed to ⅛. The vein while considerably enlarged was not as large as the artery. When the artery was lifted the thrill was intensified and the note of the bruit rose until it could be plainly heard by the operators.

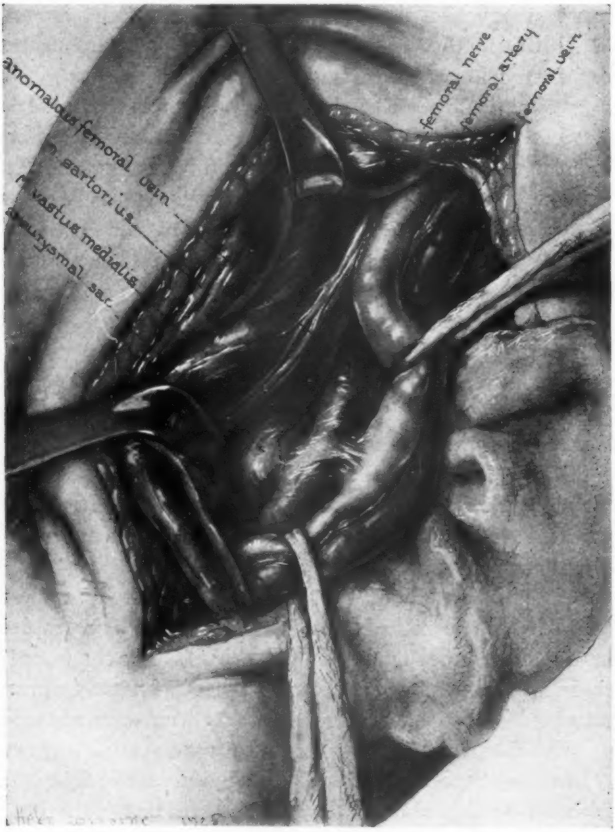

anomalous femoral vein
m. sartorius
m. vastus medialis
aneurysmal sac
femoral nerve
femoral artery
femoral vein

Fig. 306.

The vein was separated from the artery and ligated high up at least $2\frac{1}{2}$ inches. It was noted that there was no communication between the artery and this vein. The artery was then ligated above and below and the femoral vein was then ligated below. After this quadruple ligation, which was done with linen, the two great trunks were divided above and below and a dissection of the intervening segment was begun. This brought into view what had been readily felt but imperfectly seen before, a well-defined aneurysmal sac about the size of a pigeon's egg, immediately behind and a little internal to the artery. A vein

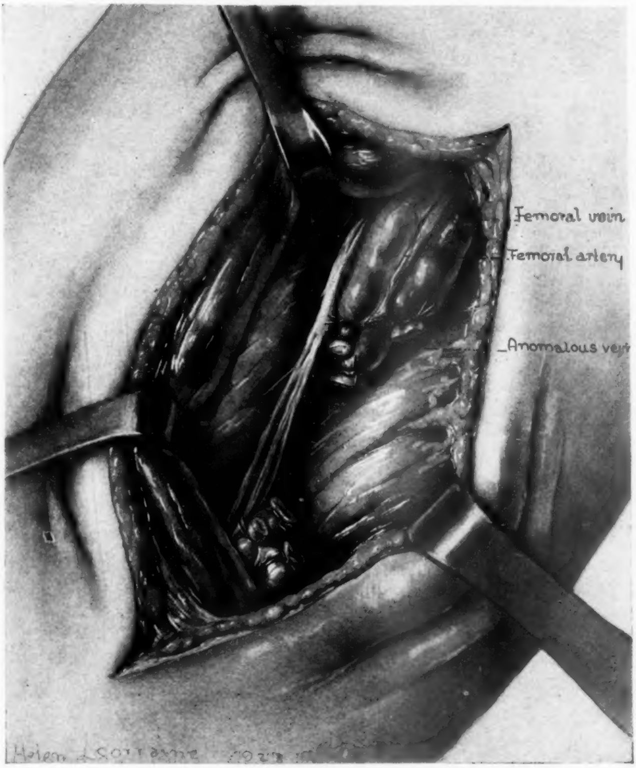


Fig. 307.

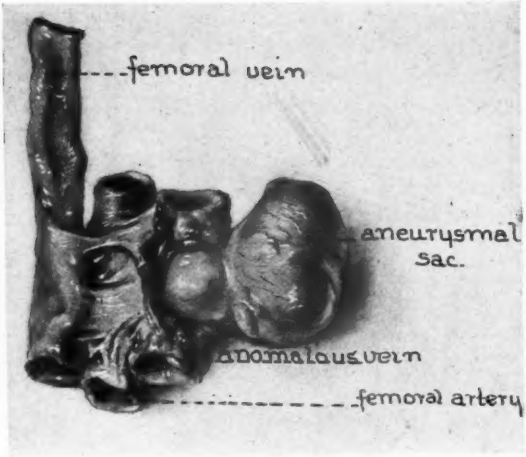

femoral vein
aneurysmal sac.
anomalous vein
femoral artery

Fig. 308.

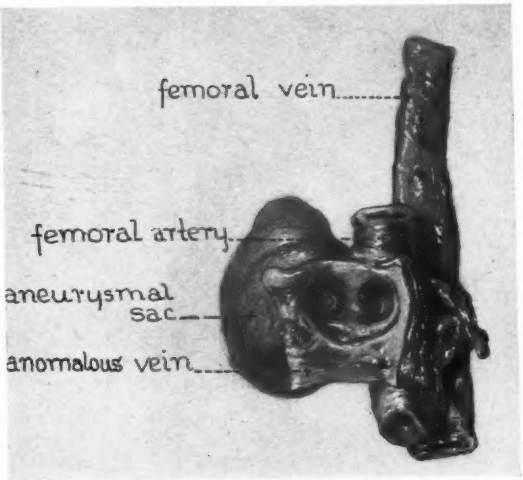

femoral vein
femoral artery
aneurysmal sac
anomalous vein

Fig. 309.

larger than the femoral, and probably an anomalous femoral, lay immediately beneath the artery and intimately attached to it. Beneath this and a little internal to it lay the sac. It was opposite the hole in the artery and was as though the force of the jet of arterial blood had blown out the wall before it. This anomalous femoral was also ligated above and below with linen and then the sac was easily dissected out. Several venous collaterals which opened into the sac were also tied and divided. The six large stumps and the several little ones were examined and as the wound was quite dry it was closed without drainage.

It was noted that the pulse, which was 100 and of good volume and regularity just before the artery was tied, dropped to 80 when the ligature was seated. In ten minutes it had dropped to 78, and was irregular and rocky. It then went to 72 and was skipping; in the next fifteen minutes it was 72 and regular, and its volume good.

Though the whole leg was wrapped in cotton and kept warm, at no time did the capillary circulation seem to differ from that of the left foot. The pulse of the dorsalis pedis which stopped when the artery was tied had not returned when he left the hospital November 19th.

On December 10th he was seen again, and at this time he was walking easily without crutch or cane. There was no pain, soreness or edema, and he asked to be allowed to go to work on the 17th, just four weeks after his discharge from the hospital. He has had no discomfort about his heart, and the tumultuous throbbing of his right femoral artery has subsided.

He reported again on February 7, 1929, three months after operation. His general health was excellent. He was at his work and suffering no inconvenience whatever. There was no edema of the foot or leg. The tied femoral was much smaller and far less bounding. The iliac, though still greatly enlarged, was smaller and its pulse much diminished in intensity. His pulse was 74, and what is very unusual, it returned in both the dorsalis pedis and posterior tibial. His blood pressure in the arm was 123/70, a rise of 30 points in systole, indicating a return to normal function of the heart. A radiogram of his chest for comparison showed a cardiothoracic ratio of 5¼ to 11¼. This shrinkage of ½ inch in its transverse measurement brings the heart back almost to normal limits again.

The history and development of the rational treatment of this condition makes fascinating reading, so much so that one is apt to stray too long in one of the many bypaths that stretch so temptingly in every direction. No paper, or even a report, seems proper unless one pays homage to Halstead, Reid, Holman, Callender, Sir George Makins, Von Oppel, Koratkow, and a number of other painstaking gifted men, who have brought order out of chaos in this condition. To bring the subject to a practical basis it may be best to discuss it under several headings:

Diagnosis.—With the symptoms and signs of a bruit and a thrill, Bradford's bradycardia, a dilated proximal vessel, and an enlarged heart following a gunshot or stab wound, there is little room for error, but even in a picture less typical mistakes should occur but seldom.

Prognosis.—If there be an aneurysmal sac, it carries with it all the dangers of pressure changes, and finally of rupture that an aneurysm does alone; but whether it be just a simple fistula, or a fistula and a sac combined, it carries with it another very definite danger if left untreated over long periods of time; and this is the dilatation of the vessel proximal to the fistula and hypertrophy of the heart with serious structural changes in both.

Treatment.—This divides itself into two practical questions. First, when should one start? Second, how much should one do? If the case is seen early, many advocate waiting until all local reaction has subsided, so that dissection may be clean and easy, and also that collateral channels may be developed to their maximum. If this delay occasioned no risk, there could be no question raised as to its advisability. However, as pointed out by Holman, in cases of large fistulae, the proximal vessel and heart changes are very rapid. And, again, the excellent results in traumas requiring immediate ligation lead us to believe that we may have overestimated the importance of the development of the collateral circulation in cases of fistula. In regard to the second question, how much should one do, the answer is quadruple ligation certainly, and excision of the intervening segment if it can be done without undue hazard. Even with well-seated ligatures of linen or silk the condition is apt to recur if excision is not done, by reason of numerous branches that open into the sac itself.

The last question, should we tie and divide the large normal healthy veins that drain the part in order to equalize or balance or stabilize the circulation? This is indeed a trying question to decide, for when it first presents itself to us we have to reverse our intellectual circulation and start our habit of thought backward to take it in. It is difficult at first to accept "in principle" as the diplomats say, but when one must act upon it and accept all the attendant responsibilities, it is one of the hardest decisions one ever has to make. One anxiously reads Sir George Makins on "Gunshot Injuries to the Blood Vessels." His array of fact and argument that made it almost mandatory for French and English surgeons in the World War, when ligating an artery to also occlude the accompanying vein. He stated that ligation of the artery alone was followed by gangrene in 40.27 per cent, whereas, simultaneous ligation of both artery and vein under the same conditions gave but 24.5 per cent, and "I speak only of gangrene from ischemia," he says.

One also reads of Von Oppel's remarkable case of arteriovenous aneurysm involving the axillary artery and vein in which three separate operations were done in one day to ward off an impending ischemia of the hand. At the first operation he ligated the axillary artery just above the sac. At the second, he ligated the axillary vein and a second deep axillary vein and divided them. At the third the sac was dissected out and the collaterals were tied and divided. After the third operation, the pain which had been intense stopped and the hand which had become blanched each time now remained pink for the circulation had become stabilized. All these make good comforting reading the night before a contemplated operation.

Under the operative treatment I have spoken only of ligation and have not described the many ingenious methods that have been employed in separating the artery and vein and suturing the openings and thus restoring the original channels. All of these procedures require a highly specialized technic, only developed by long patient practice. Even in the hands of the expert there are only a few of these cases that lend themselves to this type of operation. In the hands of the general surgeon ligation followed by excision is far safer and simpler than the more highly technical procedures. In fact one wonders in some of them, as described in print, whether after all the final result is not just a ligation rather elaborately and hazardously performed.

There are many inviting fields to this fascinating subject, for theorizing, discussion, argument, and even controversy. Time will allow me to touch on only one of them. I do this as a recorder only, and I call attention to it because of its practical bearing on the outcome of these cases. I refer to the enlargement of the proximal artery and the heart, and will give the views of some of the investigators as to just what brings about these changes.

Hunter in 1762 regarded it as "due to the lessened work the artery had to do." Hodgson states that "it is due to that property by which the size of arteries becomes adapted to that of the parts which they supply." Broca concludes that "the lessened pressure resulting from the deviation of blood through the fistula calls to the part a larger quantity of blood and that the calibre of the vessel places itself in harmony with the amount of blood traversing it." Bourges thinks "the proximal artery loses its tone through vasomotor changes, etc." Debert thinks "it is a dilatation due to a disuse atrophy, since the artery needs no longer to contract against its customary arterial pressure." Reid says "it would be unusual if a simple handling of an increased volume of blood by the proximal vessel did not lead to an hypertrophy and strengthening of its walls." Dr. Emile F. Holman, who has done an immense amount of original work in this particular field of the subject, believes the enlargement of the proximal artery and the heart are directly due to the increased volume of blood they are required to handle under the changed conditions. He also states that the degree of these changes and the time at which they appear are directly dependent upon the size of the fistula. In the large fistula we might expect marked changes early. If the fistula is small they are less pronounced and longer in manifesting their presence. His statements are amply buttressed with the most clear-cut and convincing experimental proof.

In closing let me again present the picture of the stabilized circulation. We have long known that certain large arterial trunks could be ligated without causing gangrene to the part or limb supplied. We have known the part the collaterals have played in these new circumstances. But I think we have all pictured the tissues of a limb as dependent upon a rushing stream of well-oxygenated blood as a *sine qua non* to the life of its component cells. We have certainly in the past most painstakingly preserved the veins that drain the limb when the artery had to be ligated. If we remember that tissues are now being grown in test tubes with no circulation at all, that arteries so sclerosed and blocked that only a tiny trickle of blood gets through them may still keep a limb alive, and when we read of the large number of limbs that are perfectly normal with artery and vein resected, we have a new conception of normal tissues living in a greatly slowed but balanced or stabilized circulation.

CLINIC OF DR. WILLIS C. CAMPBELL

Dr. Willis C. Campbell Clinic, Memphis, Tenn.

FUSION OF TUBERCULOUS JOINTS

Operative measures for the purpose of eradicating tuberculous foci were extensively employed about thirty years ago. However, with the exception of certain joints, as the elbow, the results were so disastrous that such measures became obsolete, and there followed a period of extreme conservatism. Recently, surgical procedures have again become popular, but with an entirely different objective, the purpose being solely to induce osseous ankylosis of the affected joint, as it has been observed that, when fusion is accomplished by nature or induced by operation, the tuberculous process becomes arrested in a high percentage of cases. Surgeons who advocate surgical arthrodesis claim that conservative methods have proved so universally unsuccessful that they should be discarded. To this the author does not fully concur, as cases are often observed in which the tuberculous process in a joint has remained apparently cured or arrested for a long period of time. The author, with the aid of one of his former associates, Dr. C. R. Robertson, made a survey of 454 cases of tuberculosis of the spine, hip, and knee, in which routine conservative measures and heliotherapy were employed. Of this number accurate records as to the results could be secured in 173 cases. No case was considered unless at least five years had elapsed since treatment was discontinued; in many, no treatment had been necessary for ten or fifteen years. Of the 173, 86 were apparently cured, without the slightest evidence of activity since treatment was discontinued. In 52 the process was definitely active as evidenced by such symptoms as pain, muscular spasm, or draining sinuses. Twenty-eight died of tuberculosis elsewhere in the body and 7 of intercurrent disorders. The statistics compiled by Dr. Russell Hibbs, of New York, and his associates, are not so favorable. This variance, however, may be explained probably by the difference in environment. Our series consisted largely of private patients whose living conditions were superior to those of inhabitants of crowded districts in a large city.

The results in our series indicate that while excellent results may be obtained by conservative methods, the percentage in which the process remains active is exceedingly high. Also if the patients who died are included, the poor results are further increased; even the most favorable results leave much to be desired. The question to be considered, therefore, is not whether conservative measures or surgical procedures employed in the past have proved absolute failures and that such treatment must be supplanted, but whether or not it is possible to improve our results by an additional method.

The principle of arthrodesis or surgical fusion of a joint is the same as that employed in the past; to induce rest to the part by fixation. Fusion is simply a more continuous and efficient method of fixation. It is also possible that by the instigation of new bone formation or osteogenesis in the region of a degenerative process repair may be favorably affected incidently and the evolutionary process thereby caused to recede. Tuberculosis in a joint, as elsewhere in the body, must not, under any circumstances, be regarded as a purely local process, and all measures to raise the stamina of the patient should be enforced strictly throughout the entire period of treatment. As the process often remains dormant without active symptoms, recurrences are frequent, therefore, the results must be recorded in terms of arrest and not cure. There is no reason to assume that the induction of osseous union will absolutely prevent a relapse, as this has been observed, even in those in whom ankylosis was present. However, it is believed that fusion has a definitely beneficial action on the pathologic process, as well as by rendering the results more permanent with less chance of recurrence. Operative measures for the purpose of fusion are not radical procedures, but result ultimately in the conservation of tissue and are valuable adjuncts to other well-known and long-tried methods.

The indications which materially influence the results must be carefully considered and may be described as follows:

1. The diagnosis of tuberculosis must be established before operative treatment is selected. This quite often may be difficult, especially during the early stage. If the disease is in accessible joints, as the knee, elbow, and ankle, a biopsy may be required before differentiation can be made from other types of low-grade arthritis.

2. In patients above fourteen years of age fusion should be induced as early as possible, unless operation is otherwise contra-indicated from some local or general condition.

3. In children under five years of age, fusion is difficult to secure, on account of the preponderance of cartilage in the articular extremities of the bones. This has been definitely proved in operative measures for anterior poliomyelitis. Fusion is attempted by some surgeons at any age, but the author has rarely employed the procedure under the age of six.

4. The stage of the existing pathologic process has a definite influence upon the success of osseous fusion. At the onset before there has been extensive destruction, or bone atrophy, the bone is more favorable for securing osseous union. This is also true after the initial activity of the process has subsided and the disease has become somewhat dormant. While there is extensive and progressive destruction or abscess formation, the chances of success are less, and the danger of secondary infection with possible sinus formation is greater. However, the procedure is not absolutely contra-indicated at any stage.

5. The operation may be performed even in the presence of an active secondary pyogenic infection, but the chances of a successful result are materially lessened.

6. The possibility of deformity in children as growth advances must receive due consideration. This may be due to an imbalance between the development of the soft parts and the bone or to irregular or arrested growth in the epiphyses after fusion. Should deformity recur after fusion, correction can be made when adult age is reached by simple extra-articular osteotomy. The advantage of fusion by eradicating the process is so great that the

possibility of subsequent deformity should not be considered as a contra-indication.

The operative technic and the indications differ to some extent in the different joints. Whenever possible from a mechanical standpoint, osseous union of the bones forming the articulation should be secured, outside of the joint cavity, that is, an extra-articular arthrodesis. Invasion of the tuberculous process should always be avoided, if feasible; however, this cannot always be accomplished. The methods employed depend upon the anatomical construction of the joint and may be classified as: (1) Intra-articular; (2) extra-articular; (3) intra-articular and extra-articular.

The intra-articular method consists of removing all articular cartilage and a thin section of bone from the ends of the bones, so as to approximate fresh osseous surfaces. No attempt is made to curet or excise the diseased tissue, as advocated formerly. The advantages of the intra-articular technic are that a better mechanical correction of deformity, when present, can be secured, and a specimen of the diseased tissue can be obtained for microscopical examination. In children it is difficult to secure osseous union on account of the preponderance of cartilage and in adults union is often slow. There is also a greater danger of relighting an active process and of causing a secondary infection. The author attempted in a small number of cases about fifteen years ago to fuse the knee joint in children by pegging the joints with intra-articular osseous grafts. This proved quite satisfactory for a number of months, but the grafts later became absorbed and movement returned. Other surgeons have also attempted to secure fusion by this method and have reported successful results. The procedure has been discarded, as we believe that it is not physiologic, because we have observed that bone grafts become absorbed at a point of undue strain.

Extra-articular fusion is the induction of osseous union between the component bones forming the articulation, but entirely exterior to the joint cavity. This is accomplished by plastic bone flaps from the bones forming the articulation and by placing additional autogenous bone grafts when sufficient osseous tissue cannot be secured in the vicinity of the joint. The procedure is conducted entirely in normal bone tissue not involved in the pathologic process, and is analogous to the Albee and Hibbs' procedures which have proved quite successful upon the spine. When extra-articular fusion is successful, intra-articular fusion always follows, although the time necessary for such fusion has not yet been determined.

A combination of intra-articular and extra-articular methods is perhaps more commonly employed. This consists of entering the synovial cavity as in the intra-articular method, but the articular surfaces are disturbed as little as possible. Fusion is induced by the plastic rearrangement of adjacent bone, or by transplants to bridge the articulation. In certain joints, on account of anatomical construction, it is difficult or impossible to secure fusion without entering the joint.

A complete discussion of the technic employed for the ankle, hip, knee, and sacro-iliac joints will be given, the principles of which may be applied to other joints.

THE ANKLE

Arthrodesis of the ankle is indicated in adults, but not in very young children, on account of the difficulty in securing osseous fusion when there is a preponderence of cartilage. The age at which fusion should be attempted has not been determined. However, the author believes that extra-articular fusion in the ankle may be secured in well-developed children after the age of seven. In all adults with tuberculosis of the ankle fusion should be induced as early as possible, for two reasons: First, a subsequent relighting of a latent process elsewhere in the body is not uncommon in tuberculosis of the ankle; second, conservation of time is frequently required for economical reasons. Should there be failure, which can be determined at the end of six months, amputation will terminate the process and by the use of an artificial limb below the knee the individual will be restored to normal activity.

The technic of fusion of the ankle by the extra-articular method is as follows: An incision is made extending from the

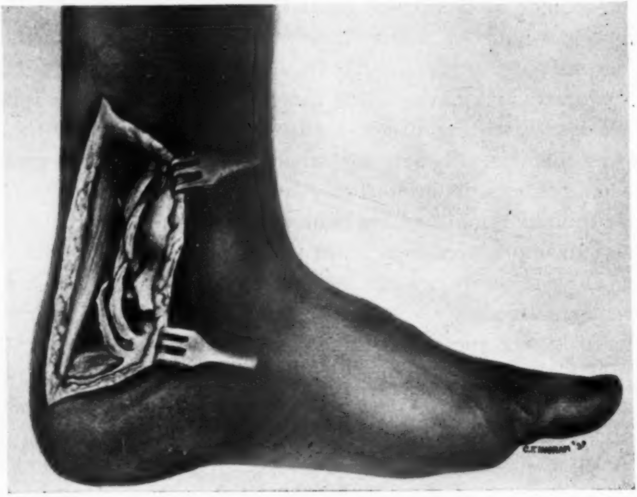


Fig. 310.—Extra-articular fusion of ankle joint. Posterior incision.

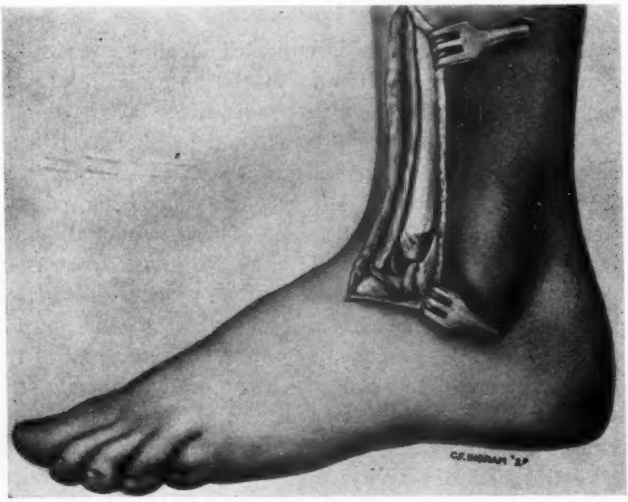


Fig. 311.—Same as Fig. 310. Anterior incision.

lateral aspect of the tuberosity of the os calcis upward about 4 inches parallel with the tendo achillis. Dissection is then made beneath the tendo achillis which is retracted mesially; if the tendon is contracted, it may be lengthened by the Z-plastic method, but this is rarely required, except in late cases. Dissection is made in the midline through the pad of fat and areolar tissue directly to the posterior capsule of the ankle. The lower 3 or 4 inches of the tibia and posterior capsule of the ankle and the superior surface of the os calcis are exposed, especial care being taken to retract the tendon of the extensor hallucis longus inward. The superior surface of the os calcis and the posterior 2 to 4 inches of the tibia are denuded. Numerous small fragments of bone are turned downward from the tibia so as to make a continuous mass of overlapping bone. A mass of bone is also removed from the superior surface of the os calcis and placed in contact with the denuded posterior surface of the tibia. The entire mass is compressed with a periosteal elevator so as to make uniform approximation of the fragments. If sufficient bone cannot be thus secured or if the quality is poor, an osteoperiosteal graft may be secured from the opposite tibia.

A second incision is then made on the anterior aspect of the ankle, beginning approximately 3 inches above the joint and about 1 inch internal to the fibula, and extending down to the external cuneiform bone. The soft structures are incised until the lower extremity of the tibia and the upper aspect of the neck of the astragalus are well exposed. The anterior surface of the lower extremity of the tibia and the upper surface of the neck of the astragalus are denuded. An osteoperiosteal graft 3 inches in length and 1 inch in breadth is taken from the opposite tibia and anchored by sutures of No. 1 chromic catgut to the structures surrounding the denuded surfaces. The wounds are then closed and a plaster cast applied extending from the toes to just below the knee, holding the foot in moderate equinus. At the end of four months osseous union is usually firm and a leather corset brace which practically duplicates the cast is applied. Weight-bearing, if not painful, may be permitted in the cast at the end of six weeks, and is gradually increased, until full weight is borne.

By this technic, the subastragalar joint is fused, as well as the ankle joint. It is possible that fusion may be accomplished by the posterior route alone, but as the conservation of time is so important, especially in adults, the method which insures the greatest chance of success should be selected.

Case I.—A woman, aged thirty-five years, was examined April 10, 1926. At the age of ten years the patient sprained the left ankle. An abscess formed which ruptured spontaneously and there was a daily elevation of temperature for a period of over three years. The symptoms then subsided and remained quiescent until the patient was twenty-seven years old. For three months, preceding the examination, walking was possible, only with crutches. The roentgenogram revealed an old destructive arthritis of the left ankle joint. The articular surfaces of the tibia and astragalus were eroded, the body of the astragalus was flattened and all bones of the foot showed osteoporosis. The Wassermann test was negative. In May, 1926, an intra-articular fusion of the joint was performed. The wounds healed, but bony fusion did not occur. A second operation by the extra-articular method was performed October, 1927. The tibio-astragalar joint was refreshed, the subastragalar and midtarsal joints denuded of cartilage and an osteoperiosteal graft from the tibia placed across the joint anteriorly and chips of bone from the os calcis and tibia placed posteriorly. Fusion occurred rapidly; by October, 1928, the arthrodesis was solid, the foot was in good functional position and the pain had been entirely relieved.

Case II.—A woman, aged thirty years, was examined March 7, 1928. The ankle had been painful since she had sprained it in May, 1927. For four months the pain had become insidiously and progressively worse, and for two months she had been unable to bear her weight on the left foot. The joint was swollen, the local heat was increased, and passive and active motions were limited. The roentgenogram demonstrated a narrowing of the joint space, an erosion of the articular surfaces and osteoporosis of the bones. The Wassermann test was negative. An extra-articular fusion operation was performed March, 1928, using two osteoperiosteal grafts from the opposite tibia. Following the operation the wounds reopened and discharged a thin serous fluid. The sinuses healed sufficiently after eight months to allow the application of an ankle brace and to permit the patient to begin weight-bearing.

Case III.—A woman, aged sixty years, was examined August 31, 1926. For nine years the joint had been painful on use and two years previously a cast had been applied and worn for a short time. The entire foot and ankle were held rigid, but there was no hyperemia or fluctuating. The roentgenogram showed destruction and erosion of the calcaneocuboid and astragaloscaphoid joints. The Wassermann test was negative and the general examination was essentially negative. April 24, 1927, an extra-articular fusion of the joint was performed, including the midtarsal joints. From tissue removed from the joint at the time of the operation tuberculosis was diagnosed. The foot was immobilized in a cast for three months, after which time walking was permitted in a brace. The result was excellent.

THE KNEE

In tuberculosis of the knee, the author employs a modification of the Hibbs' technic. An incision is made internal to the quadriceps tendon, beginning about 4 inches above the knee and extending downward parallel to the patella and patellar tendon to just below the tibial tubercle. The synovial cavity is entered in this line giving an excellent exposure of the joint; a section of the diseased tissue should be removed for microscopical examination. The patellar tendon is divided by a Z-shaped incision so as to elongate this structure in closing the wound should this be required. The patella is then denuded, removing the cartilage from the posterior surface and the fibrous tissue from the entire circumference including a small area on the anterior aspect. Cavities are made on the contiguous surfaces of the femur and tibia of the same dimensions as the patella. The denuded patella is then placed in contact with the freshened surfaces on the femur and tibia and so anchored by No. 1 chromic catgut sutures to the surrounding soft structures. The severed ends of the quadriceps tendon are sutured to each other and to the surrounding muscles and the wound is closed. A spica cast is applied extending from the toes to the iliac crests to insure complete immobilization.

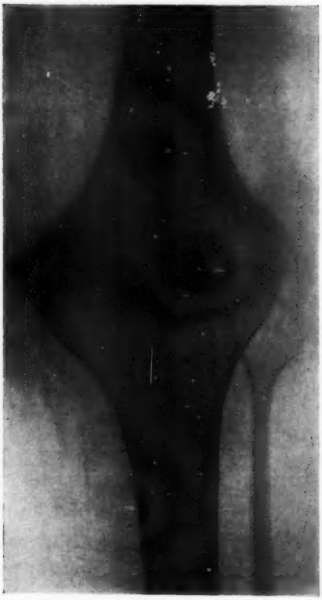


Fig. 312.—Intra-articular and extra-articular fusion of knee joint. Anteroposterior view.

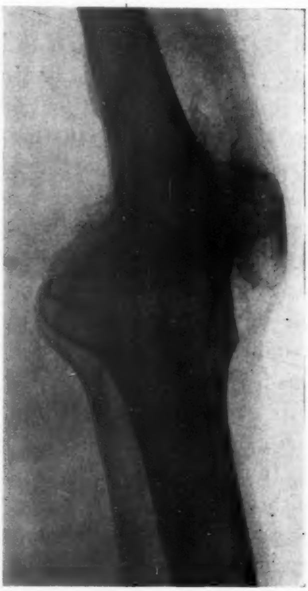


Fig. 313.—Same as Fig. 312. Lateral view.

The knee is placed in complete extension, locking the joint and holding the patella in place. In this position there is undoubtedly a much better chance of securing fusion, the success of which is so important that no license should be taken in placing the limb in flexion, even though the position of slight flexion is more favorable from the standpoint of future service. As ankylosis occurs slight flexion may be often permitted, or if it is desirable to change the position to the most serviceable position, an extra-articular osteotomy at a later date is safe and can be accomplished with ease. Bony union may require many months, during which time there must be complete fixation. A leg corset is applied at the end of four months, extending from the ankle to the groin.

This procedure is entirely intra-articular, as it is almost impossible to reach the surface of the bones, and to secure the desired extent of union and at the same time avoid the joint. Osteoperiosteal grafts have been employed in addition to bridge the lateral and mesial aspects of the joint when the condition of the osseous structure was such that osseous fusion was regarded as doubtful. Also the osteoperiosteal grafts alone have been used to bridge the joint, but not in a sufficient number of cases to warrant conclusions as to the relative value of such procedures. Arthrodesis of the knee has also been accomplished by the author and others by excising the cartilage and a very thin layer of bone from the articular surfaces of the tibia and femur. This procedure, however, is often followed by persistent drainage with greater danger of secondary infection and in consequence has been discarded. If there is flexion deformity, the intra-articular method is indicated; sufficient bone is removed to permit anatomical realignment with close approximation of the osseous surfaces. When there is as much as 50 degrees flexion this approximation may often be secured and at the same time maintain the joint in the most serviceable position, which is about 30 degrees flexion.

Case IV.—A girl, aged eighteen years, entered the hospital July, 1926, complaining of a stiff, painful right knee. At the age of eleven years, she had fallen and injured the knee. The joint became swollen and within three months was stiff. The limitation of motion persisted, the knee became flexed and there was a dull aching pain on use, and at times severe night pains. The soft tissues about the joint were boggy, the muscles of the thigh and calf were atrophic and there was posterior subluxation of the tibia on the femur. The Wassermann test was negative. The roentgenograms showed erosion of the articular surface of the joint. Arthrodesis of the knee was performed July 19, 1926. In July, 1927, there was solid bony ankylosis and no evidence of activity of the disease process.

Case V.—A child twelve years of age was examined December, 1926. When one year old the right knee became swollen and slightly painful. The condition had grown progressively worse and there was a localized enlargement on the medial aspect which was tender on pressure. Motion was restricted and painful and muscular atrophy was present in the entire right leg. The roentgenogram showed a destructive type of arthritis. The Wassermann test was negative. Operation was performed December 21, 1926. The convalescence was uneventful. The patient was able to discard the brace after one and a half years and at the present time the joint is solidly ankylosed and free from pain.

THE HIP

The hip joint is well adapted to extra-articular fusion. An incision is made from just below the crest of the ilium downward in line with the greater trochanter to a point 3 or 4 inches below, on the shaft of the femur. All muscles are severed, exposing the dorsum of the ilium, the trochanter and 3 inches of the external aspect of the shaft of the femur, but carefully avoiding incision into the joint capsule. The ilium is denuded by turning down massive osseous flaps of cavernous bone; the trochanter and adjacent portion of the external surface of the femur are likewise denuded. Osteogenetic bone shavings are thus secured in as large an amount as desired from the ilium and from the femur. An osteoperiosteal graft of suitable dimension is then secured from the tibia and is closely approximated to the denuded surfaces of the dorsum of the ilium and the femur. Bone shavings are placed about the graft extending from the shaft of the femur to the ilium. These are closely packed by a periosteal elevator and the wound closed. This approach may be criticized, as important muscle fibers are severed in their transverse axis, but with an ankylosed hip there will be no function in these muscles. The hip is placed in line with the body, slightly abducted, and in neutral position between internal and external rotation. A plaster cast is applied which extends from the toes of the affected side to the nipple line and to the knee on the unaffected limb. At the end of two months the cast is changed and a second one applied from the toes to the nipple line on the affected side, but the normal limb is excluded; walking with crutches is then permitted. In adults fusion is solid in four months, while in children about eight months is required. When union is solid, a brace is applied which extends from the chest to the sole of the shoe to prevent adduction which may occur insidiously. The brace is worn from six months to one year, or until the osseous union is completely organized. After removal of the apparatus adults should be observed for one year and any impending adduction prevented by resuming the brace for a longer period. Children should be observed for many years, as the diseased process may cause irregularity in growth and deformity, which also should be prevented, if possible, otherwise an osteotomy where growth is attained is a simple measure. Flexion and adduction deformity can be corrected

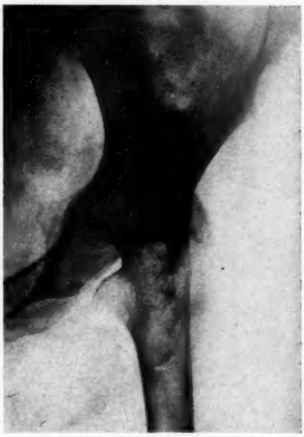


Fig. 314.—Extra-articular fusion of hip joint. Solid osseous union.

by extra-articular osteotomy at the time of the fusion operation, the lower end of the osteoperiosteal graft being placed between the fragments of the severed bone.

In the early stage, opening into the hip joint can always be avoided, but in those with distention of the capsule or when the process is peri-articular, invasion of the tuberculous area may be necessary. In all cases, the danger from this source is obviously minimized by the extra-articular procedure. In very anemic or debilitated children, the osteoperiosteal graft may be secured from the mother or other near relative. In such cases, blood typing should show that the bloods match. It is said that in bone transplants the typing of blood is not indicated. The author prefers that the blood groups be compatible.

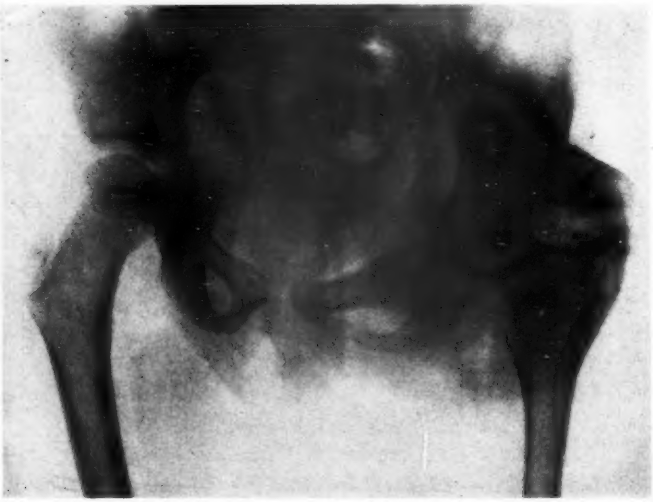


Fig. 315.—Extra-articular fusion of hip joint in child obtained by osteoperiosteal graft.

Subsequent roentgenograms demonstrate that the osteoperiosteal graft, together with the loose osteogenetic particles, proliferate and form a continuous solid mass of bone extending from the trochanter to the ilium. The process in the hip joint gradually recedes, and the bone structure becomes more dense and approximates the normal. At the end of eight months the amount of new bone is three or four times greater than the original transplant. In those in whom homogeneous grafts are used, the proliferation is less than in those in whom autogenous transplants are employed, but of sufficient dimension to insure osseous fusion.

The comparative value of the extra-articular method described and the method of Hibbs, from a mechanical standpoint, is that the former has the advantage of securing direct fusion in the angle between the neck of the femur and ilium. At this point the leverage action of the femur is not great and, therefore, subsequent adduction through the pull of the powerful adductor muscle is less apt to occur. The end-results have been excellent in a limited number of cases, as may be demonstrated by the following:

Case VI.—A boy, thirteen years of age, was examined February, 1927. The left hip was contracted and the leg apparently shortened. When three years old the hip had been injured by falling. The joint remained painful and stiff and two years previous to the examination an abscess had formed on the hip which ruptured and drained pus for about eight months. At the time of the examination he had no fever and his general health was good. He walked with the aid of one crutch. The hip was fixed in a position of 45 degrees flexion and adduction. The entire left lower extremity was moderately atrophic. The roentgenogram showed erosion of the acetabulum and head of the femur and an upward displacement of the femur. The Wassermann test was negative. On February 27, 1927, an extra-articular fusion of the left hip was performed. An osteotomy of the femur was done below the greater trochanter to correct the flexion and adduction deformity, and an osteoperiosteal graft was used to bridge across the joint from the ilium to the upper end of the femoral shaft. The hip fused solidly, in excellent weight-bearing position, and the boy walks with only a slight limp.

Case VII.—A boy, aged eight years, was examined December 8, 1927. Two years previously while playing he fell on the right hip. He was unable to walk afterward because of pain. The diagnosis of tuberculosis was made and a cast applied. Later, treatment was discontinued and the hip became contracted and the leg shortened. When examined, the joint was held flexed and adducted. There was no swelling or tenderness about the hip. The roentgenogram showed narrowing of the joint space with atrophy and erosion of the bones of the hip. The Wassermann test was negative. The deformity was corrected by gradual traction and on March 24, 1928, an extra-articular fusion was performed, using an osteoperiosteal graft. A brace was worn until October, 1929, at which time ankylosis was solid.

THE SACRO-ILIAC JOINT

Tuberculosis of the sacro-iliac joint is of comparatively rare occurrence. In children it is observed so seldom as to be almost dismissed as negligible. In the adult, fusion should be secured as soon as the diagnosis is made, and if possible before there has been extensive bone destruction or abscess formation. Abscesses

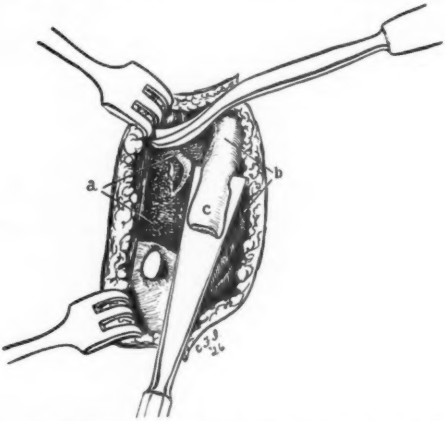


Fig. 316.—Extra-articular fusion of sacro-iliac joint. Removal of a portion of the crest of the ilium: *a*, Sacrum; *b*, ilium; *c*, fragment from crest of ilium.

are frequent in tuberculosis of this joint and secondary infection is practically always fatal, therefore, the joint should not be subjected to the possibility of infection by operative exposure. As

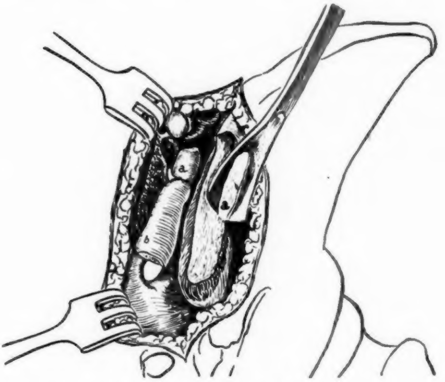


Fig. 317.—Placing multiple chips into denuded gutter formed by posterior surface of sacrum and inner surface of dorsum of ilium: *a*, Small bone particles; *b*, large bone fragment.

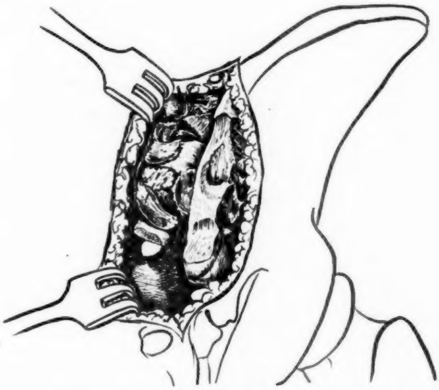


Fig. 318.—Multiple grafts completely filling the denuded gutter.

in the spine, the joint, when tuberculosis is suspected, should be fused by surgical measures entirely extra-articular and the diseased process should be undisturbed. There is one disadvantage in any extra-articular method, and that is, that the diagnosis cannot be confirmed by microscopical examination of tissue. As fusion is indicated in all low-grade infections of this articulation of long duration, no actual damage will accrue should the process be caused by some other agent. The author has devised and employed the following method for a number of years, the results of which have been reported before the Southern Surgical Association, December, 1929. The posterior one third of the crest of the ilium overhangs the sacro-iliac joint and forms, with the posterior surface of the sacrum, a large angular groove. Fusion of the joint is accomplished by denuding the superficial bone forming this space, and filling the gutter with bone, so as to obliterate the space and unite the posterior surface of the sacrum to the ilium. The joint cavity is not entered, nor irritated sufficiently to instigate a secondary pyogenic infection in a deep-seated and inaccessible tuberculous focus.

The technic of the procedure is as follows: An incision is made over the posterior one third of the crest of the ilium, dissecting down to the crest which is completely exposed. The periosteum is reflected and a small chisel is driven through the crest from without inward at four or five points about $\frac{3}{4}$ inch below the surface. A mass of bone, about 3 inches in length by $\frac{3}{4}$ inch in width, is then easily removed from the crest with a chisel. The piece of bone is preserved in a sterile towel. The spinal muscles are stripped from the posterior surface of the sacrum for about $1\frac{1}{2}$ inches. The posterior surface of the sacrum and the inner overhanging surface of the ilium are denuded with sharp chisels, forming an osseous groove or gutter. The graft removed from the crest is then inserted into this groove and packed therein snugly. Bone chips from the crest of the ilium are packed about the graft. If additional bone is needed more can be obtained from the dorsum of the ilium by pealing the muscles outward. Thus, the space posterior to the sacro-iliac joint is filled with highly osteogenetic cavernous bone. In those cases in whom the lumbosacral articulation is also diseased the osseous grafts may be extended to the transverse process of the fifth lumbar vertebra, which is easily accessible by dissecting about 1 inch above the wing of the sacrum. The wound is closed, being especially careful not to leave a dead space over the region of the grafts, as otherwise drainage may persist for some time. The patient is placed on a Bradford frame or a firm mattress for ten days, when a plaster cast is applied from chest to knee on the affected side, as complete immobilization of any joint is conducive to union. The patient remains recumbent for six weeks, though a shorter time may be sufficient. A short spinal brace with sacro-iliac belt included is applied and the patient permitted to walk.

The anteroposterior roentgenogram will demonstrate new bone formation above the wing of the sacrum uniting the sacrum to the ilium. Unfortunately, the new bone formed in the sulcus behind the joint can be demonstrated with difficulty on account of the overlapping of the anatomical structures of this region. Animal experiments are at present in progress to determine the physiologic evolution of the procedure; however, the actual value of any surgical procedure is determined by clinical results which may be illustrated by the following case:

Case VIII.—A girl, aged seventeen years, was examined in August, 1926. Two months before a curvature of the spine had been noticed. Six months previous there had been a cramp in the region of the left hip and at times a dull ache, but pain had never been severe. There was a moderate left lumbar scoliosis present with rotation of the vertebral bodies and decreased lumbar lordosis. Movements of the spine were limited and flexion of the left hip caused pain in the sacro-iliac joint. The Wassermann test was negative. The roentgenogram showed destructive changes in left sacro-iliac articulation and scoliosis of the lumbar spine. Traction to both legs on a Bradford frame for a period of six weeks failed to relieve the symptoms completely. Fusion of the left sacro-iliac joint by the extra-articular method was performed September 23, 1926. Following the operation the pain gradually disappeared. A spinal brace was worn for one and a half years. In July, 1928, her condition was practically normal.

CONCLUSIONS

Operations for the purpose of inducing fixation of an articulation are valuable and beneficial measures in tuberculosis, but must not be regarded as cures. They are valuable adjuncts which do not exclude other well-known measures in the treatment of tuberculosis. In all tuberculous individuals, heliotherapy should be employed routinely, as sunlight undoubtedly has a definite beneficial action on the evolutionary progress of a tuberculous process. In addition, orthopedic apparatus, for the purpose of rest and fixation, are applied until there is not only clinical union, but complete organization, which usually requires at least one year. It is only by regarding the problem in this light that progress may be expected.

CLINIC OF DR. ALTON OCHSNER

From the Department of Surgery, Tulane Medical School,
New Orleans

THE USE OF IODIZED OIL IN THE TREATMENT OF BRONCHIECTASIS

Today I am presenting 2 cases of definite bronchiectasis, one with moderately severe symptoms and the other with very severe symptoms.

Case I.—F. E., male, age fifty-eight years, has suffered with a cough with profuse expectoration for the past fifteen years. The expectoration has been so profuse that it was necessary that cuspidors be kept in various rooms of his home as well as in his office, because when a coughing attack would occur large quantities of sputum would be expectorated. Aside from the annoyance of the coughing associated with expectoration the patient had relatively few symptoms until August, 1928, when he was taken ill in Milan, Italy. At this time he complained of pains in his abdomen, and the condition was diagnosed as appendicitis. Upon returning to New Orleans he was very carefully examined from every angle, including complete gastro-enterological examination, *x*-ray examinations, cholecystograms, without any definite lesions having been found. During this period of time he began to lose weight and within a month his weight had decreased from 196 pounds to 185 pounds. He began having severe pains in both shoulders, most marked on the right. Because of this pain it was thought that his tonsils, which were definitely diseased, were at fault. Examination of the teeth revealed one which was apparently infected. This was extracted, which, however, brought about no relief. In January, 1929, he was again very carefully examined by a New York diagnostician and was told that his tonsils were largely responsible for his condition.

An autogenous vaccine was made from the tonsils, which was administered daily for about two weeks. Physiotherapy was used on the shoulders. After returning to New Orleans from New York he continued with vaccine therapy. However, his condition became progressively worse. Pain in the shoulders became more marked, the weight decreased to 170 pounds. In March he returned to New York, at which time it became necessary for him to go to a hospital because of symptoms which were evidently those of cardiac decompensation. At this time he was given large doses of digitalis. His pulse during the time he was in New York ranged from 120 to 130; the weakness progressed; the loss of weight continued. After returning home conservative treatment for the infection within his tonsils was tried. However, he became worse. His condition became so bad that he was practically unable to attend to his business. Having been a very active and busy executive he was forced to give up many of his activities. He would go to his office about 10.30 in the morning, return home at noon, go to the office again at 2.30, and return home at 4.30. During this period of time his pulse was about 120 and his blood pressure ranged from day to day from 110 to 180. Because of the progression of the symptoms a tonsillectomy was performed the latter part of June, at which time his weight had decreased to 151 pounds.

I was asked to see the patient in consultation with Dr. W. W. Leake in August, 1929. Dr. Leake considered the possibility of a bronchiectasis because of the profuse expectoration associated with cough, which had been present for a period of fifteen years.

Physical examination revealed relatively little except for slight limitation of movement on the right side at the base and a few râles in the fifth intercostal space anteriorly on the right side. The sputum, which had been repeatedly examined, was always negative for tubercle bacilli. Large numbers of mixed organisms were present. The sputum contained large quantities of purulent material.

A bronchography was performed according to the "passive" technic, at which time a marked dilatation of the saccular variety was found on both sides, being most marked on the right (Fig. 319). The patient was given repeated injections of iodized oil at intervals varying from five days to four weeks. The length of time between fillings was dependent upon the patient's symptoms. In all he received nineteen such introductions of iodized oil with the following results: His weight is now 188 pounds, pulse 76, blood pressure 140. He feels perfectly well, better than he has for months. The pain in the shoulders of which he complained is gone. There is still, however, some stiffness in both knees, especially when the patient has been seated for some time. Cough and expectoration are less, and the character of the sputum has changed remarkably. Instead of the frankly purulent sputum which he originally expectorated, at

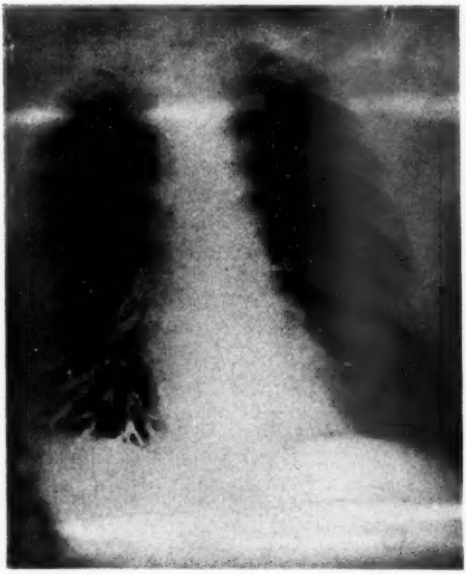


Fig. 319.—Case I. Roentgenogram of thorax following the intrabronchial injection of iodized oil. There is evidence of dilatation of the terminal bronchi of the right lower lobe of the lung of the cylindrical and saccular types.

the present time it is largely mucoid. Bronchography still reveals dilatation of the bronchi of practically the same character as that seen originally.

Comment.—This case represents a severe type of bronchiectasis in which the infection within the bronchiectatic cavities served as a focus of infection causing pain in the shoulders, knees, and occasional attacks of gastro-intestinal upset. As a result of this infection the patient had lost 45 pounds in weight within a year's time and was practically incapacitated. Following the repeated introductions of the iodized oil the patient is symptomatically relieved. He has regained all but 8 pounds of his original weight, and is able to carry on his duties as a busy executive.

The repeated introductions of iodized oil in this particular case have produced symptomatic relief from bronchiectatic infection. The dilatation of the bronchi, because of the almost certain fibrosis of the bronchiectatic cavities, has not been affected by the therapy.

Case II.—The second case that I wish to present today is a young lad, aged twenty-two, whose symptoms date back five years, at which time he had influenza. During his convalescence from influenza a cough developed which at first was unproductive. Within several months, however, expectoration became quite marked, the patient expectorating from 50 to 100 cc. in twenty-four hours. Almost simultaneously he began to have an afternoon rise in temperature and to lose weight. Because of the cough and sputum together with loss of weight and occasional hemoptysis the patient was considered as having tuberculosis, even though repeated examinations of the sputum were negative for tubercle bacilli. He was given the benefit of the doubt, however, and sent to a tuberculosis sanatorium where he remained for several months.

In April, 1928, he was referred to me for study. The boy was undernourished, anemic, and unable to work. Physical examination was practically negative except for slight limitation of motion on the left side of the thorax, especially at the base. An occasional moist râle could be heard at the base of the left lung posteriorly. There was no change in percussion note.

A bronchography was performed according to the "passive" technic. Fluoroscopy and roentgenograms revealed a definite cylindrical bronchiectasis of the left lower lobe in that area of the lung located behind the heart and below the level of the diaphragm. Visualization of the right side showed a perfectly normal tracheobronchial tree (Fig. 320).

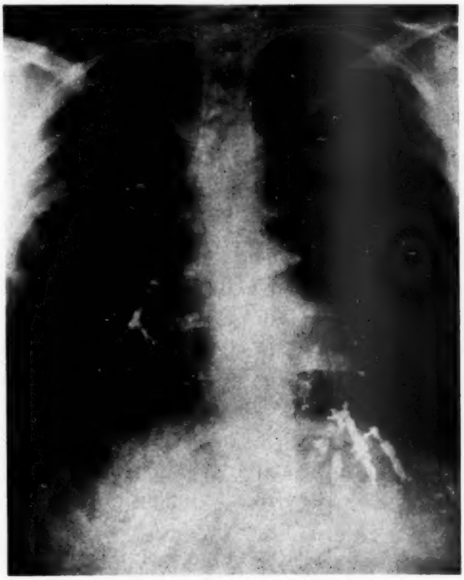


Fig. 320.—Case II. Roentgenogram of the chest following the intrabronchial introduction of iodized oil. On the right side a normal tracheobronchial tree is visible. On the left a definite bronchiectasis of the cylindrical variety is distinct. The dilated bronchi are located behind the cardiac shadow and below the level of the diaphragm.

Within the past two years this patient has received repeated introductions of iodized oil (26 in number) at varying intervals. Early in the course of treatment he received intrabronchial introductions of iodized oil at weekly intervals. As a result of the improvement, however, it became possible to increase the length of time between treatments so that at the present time a filling is done every two to three months. Within the first six months he gained 25 pounds in weight, his cough and expectoration had completely disappeared, and his general condition was much better. This patient also still has dilatation of the bronchial tree on the left side. The infection within the dilated cavities is controlled and can be kept controlled by repeated injections of iodized oil. Following an infection of the respiratory system, however, a reinfection of the bronchiectatic cavity is possible with the recurrence of symptoms.

Comment.—The treatment of bronchiectasis in the past has been very unsatisfactory, partly due to the resistance of the disease to all types of therapy and partly due to the fact that the diagnosis of the condition is often made relatively late. That bronchiectasis occurs much more frequently than is generally supposed has been emphasized in previous publications.[1, 2] Text-book descriptions of bronchiectasis must be revised, especially if diagnoses are to be made early and if the proper therapy is to be instituted. Chronic bronchitis or recurrent attacks of acute bronchitis is in the majority of instances the result of bronchial dilatation.[1]

The various types of therapy which have been advocated have been discussed in detail in a previous publication.[2] That repeated introductions of iodized oil are of value in bronchiectasis is illustrated by the reported cases. It must be remembered, however, that this type of therapy is a palliative one and in reality only symptomatic, as the underlying lesion, *i. e.*, the bronchial dilatation, is not affected. The infection, however, which is present within the bronchiectatic cavities is controlled, and as the symptoms are the results of this infection the patients become symptomatically well. It is folly to assume that a definitely rigid, fibrotic bronchiectatic cavity can be retransformed into a normal bronchus by the introduction of iodized oil. I have, however, observed 4 cases having a definite bronchial dilatation (as evidenced by the bronchogram) prior to the introduction of the therapy, which, however, disappeared following one or more introductions of iodized oil. In these 4 cases the dilatation was undoubtedly a functional one. As soon as the infection within the bronchial tree was controlled, the bronchial muscles again resumed their tone, and the bronchogram revealed a normal tracheobronchial tree.

A hundred and twelve cases of bronchiectasis which have been treated in this manner have been reported[3]: 32 per cent of these were symptomatically cured; 12 per cent of this number showed radiographic evidences of cure; 36 per cent of the group obtained symptomatic relief, but following a respiratory infection had a temporary relapse; 32 per cent were improved, but are still under treatment.

In closing I wish to say a word about the technic of introducing the iodized oil. If iodized oil is to be used in the treatment of bronchiectasis, it is necessary to employ a technic which can be used repeatedly and to which the patient will have no objection. The 2 cases here reported, as well as all of the cases previously reported, have had the iodized oil introduced according to the passive technic, which has been described in detail in previous publications.[4, 5] Briefly, it consists of abolishing the swallowing reflex by anesthetizing that portion of the pharynx at which the swallowing reflex is instituted, namely, the anterior tonsillar pillar. Following this anesthesia the patient is unable to swallow; the larynx remains fixed; the upper esophageal orifice remains contracted, and the oil which is taken into the mouth can enter only the larynx and hence pass down into the trachea and bronchi. The technic is extremely simple, one which is not objectionable either to the physician or patient, and one which allows the direct observation of the lung during the filling of the bronchi with the oil. The importance of the fluoroscopic observation of the mode of filling has been previously emphasized.[3, 5]

BIBLIOGRAPHY

1. Ochsner, Alton: Jour. Amer. Med. Assoc., 93, 188, 1929.
2. Ochsner, Alton, and Nesbit, Wellwood: Amer. Jour. Med. Sci., 175, 175, 1928.
3. Ochsner, Alton: Amer. Jour. Med. Sci., 179, 388, 1930.
4. Ochsner, Alton: Wisconsin Med. Jour., 25, 544, 1926.
5. Ochsner, Alton: Radiology, 11, 412, 1928.

CLINIC OF DRS. ALTON OCHSNER AND I. M. GAGE

From the Department of Surgery, Tulane University Medical School and the Charity Hospital, New Orleans

OSTEOGENIC SARCOMA DEVELOPING IN OSTEITIS DEFORMANS (PAGET'S DISEASE OF THE BONE)

In the original description of osteitis deformans by Paget[1] the possibility of malignant diseases being associated with the process involving the osseous system which bears his name was not only mentioned, but also emphasized. Of the 23 cases of osteitis deformans observed by him personally 5 of the 8 which were followed until the death of the individual died of some type of malignant disease. Only one of these was, however, definitely an osteosarcoma. A second case Paget[1] considered as a probable sarcoma, the remaining cases being supposedly carcinomas.

Within the immediate period after these descriptions by Paget[1] considerable attention was paid the occurrence of malignant disease in patients suffering from osteitis deformans. It was felt by Paget[1] and other authors that these individuals were more susceptible to malignant processes than other patients and that they were evidently as, or possibly more, predisposed to carcinomatous lesions as to sarcomatous lesions. Packard, Steele, and Kirkbridge[2] were able to collect 67 cases of Paget's disease from the literature at the time of their report in 1902. Of these cases, 3 had cancer (4.5 per cent), 5 had sarcoma (7.5 per cent), and 2 had benign tumors. Williams[3] believed that the malignant lesions associated with osteitis deformans were quite distinct from the ordinary carcinomas and sarcomas. He believed, because of their "myeloid structure," that these tumors were similar to multiple myeloma. According to Speiser[4] sarcoma occurs as a complication of Paget's disease in about 2 per cent of all cases, and he does not believe that its occurrence is incidental. In support of this he quotes Milieki,[5] who found in 7186 autopsies, in the Hansemann Institute, 560 malignant tumors, a percentage of 7.5. Of these there were 516 carcinomas and 31 sarcomas, and of the latter there were only 5 osteosarcomas. Osseous sarcomas represented only 0.07 of 1 per cent of the entire number of autopsies. Speiser,[4] therefore, believes that the occurrence of sarcoma in Paget's disease is thirty times more frequent than one would anticipate the development of sarcoma in the osseous system. Codman[6] states that about 14 per cent of all cases of Paget's disease succumb to osteogenic sarcoma. Kolodny[7] found that 5 per cent of osseous sarcomas registered in the Bone Registry of the American College of Surgeons originated in bones involved with osteitis deformans.

From the above statistics it can be quite readily accepted that osteogenic sarcoma is especially apt to occur in osteitis deformans. Higbee and Ellis[8] found only 5 cases of sarcoma (3.1 per cent) among 158 cases of osteitis deformans collected from the literature. It is almost universally agreed at the present time that sarcoma occurring in bones affected with osteitis deformans is the result of the previous osseous lesion and is not merely incidental. Bird[9] calls attention to the fact that sarcoma of the long bones usually occurs in younger individuals. He quotes Gross,[10] who found in a study of 165 cases of sarcoma of the long bones that in 39 cases of periosteal sarcoma, the average age of onset was twenty-three. In a series of 27 cases collected from the literature in which the age of onset was stated, we found an average of fifty-four years. In Bird's[9] series of sarcomas associated with Paget's disease the average age of onset was fifty-seven years. He is of the opinion that sarcoma occurs at those periods of life when overgrowth of bone is apt to occur. In Paget's disease the overgrowth is the result of irritative processes within the bone. Segale[11] believes that the antecedent osteitis deformans plays a definite etiologic rôle in the development of the osteogenic sarcoma. In support of this he cites the well-known fact that malignant disease may follow chronic irritation. He also relates a case in which a sarcoma developed at the site of a fracture with nonunion. Gruner, Scrimger, and Foster[12] state:

"The essential difference between the sarcomatous portions and the adjoining osteosclerotic portions lies in the unrestrained multiplication of the tumor cells, which here fail to exhibit the slightest tendency to deposit bony matter around them." Because of this similarity they believe that the tumor is superadded to the osseous tissue which has been altered by the osteitis deformans.

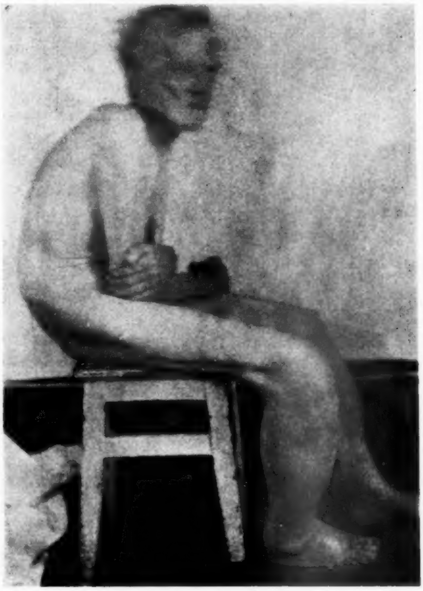


Fig. 321.—Patient H. H., Paget's disease. Photograph showing typical posture, *i. e.*, curvature of spine (kyphosis), bowing of the femora and tibiae, also marked swelling of the right leg with edema.

Cone[13] states that osteitis deformans and also the sarcomas develop principally at those points of greatest pressure and traction. Kolodny[7] is of the opinion that in the sarcoma developing on the basis of Paget's disease the tumor formation is the result of "local loss of growth restraint." This he considers of special importance in Paget's disease, especially when there is a constitutional weakness of general growth restraint.

The following case was observed by us:

Case Report.—H. H., white male, aged sixty-one years. Admitted to Charity Hospital 9/24/29. Discharged 12/3/29. Readmitted 12/25/29. Died 12/30/29.

Present Illness.—Ten years ago patient noticed that his right leg began to bow. No examination was made at this time. This bowing gradually increased. Has had to increase the size hat worn. One year ago patient fell and injured right knee. Since then has been conscious of discomfort in knee, but did not have immediate pain. The knee gradually enlarged and has become painful. Pain within the past few months has been so severe that patient has not been able to rest. For the past few weeks has been unable to walk, but is comfortable while sitting in bed.

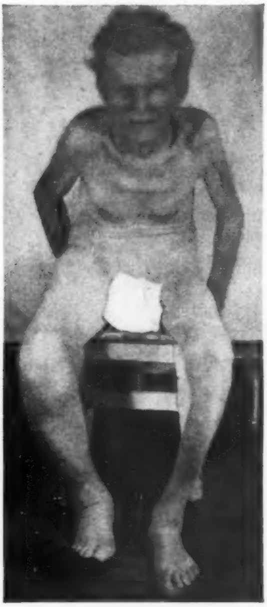


Fig. 322.—Photograph showing enlargement of the head, prominence of the shoulder girdle, especially the clavicles, kyphosis; bowing of the tibiae and edema of the right leg due to tumor at the upper end of the tibia.

Physical Examination.—This is of no importance except for the following positive points: Head is abnormally large. Hair is a whitish color. Superficial temporal vessels are tortuous and sclerosed. Bilateral partial deafness.

Anterior-posterior diameter of chest is increased. Expansion is limited. There is diffuse bowing of the entire back so that when the patient sits his spine forms a somewhat flattened letter "U" (Fig. 321). There is very definite bowing of both legs (Figs. 321, 322). The bowing is marked also in the thighs, which is most evident anteriorly and laterally. The right knee is greatly enlarged (Fig. 323). It is kept in a semiflexed position and cannot be fully extended. Markedly dilated veins are visible over the skin. There is very marked resistance in the region of the upper end of the tibia, where tenderness is present. The right

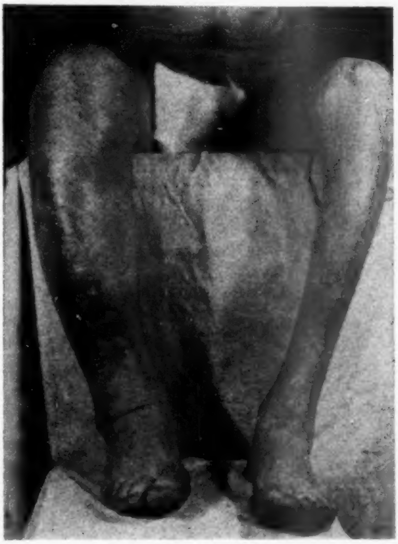


Fig. 323.—Photograph showing comparison of the right with the left leg. This photograph shows marked swelling and edema of the right leg due to a tumor at the upper end of the right tibia and popliteal space. There is discoloration of the lower thirds of the leg anteriorly.

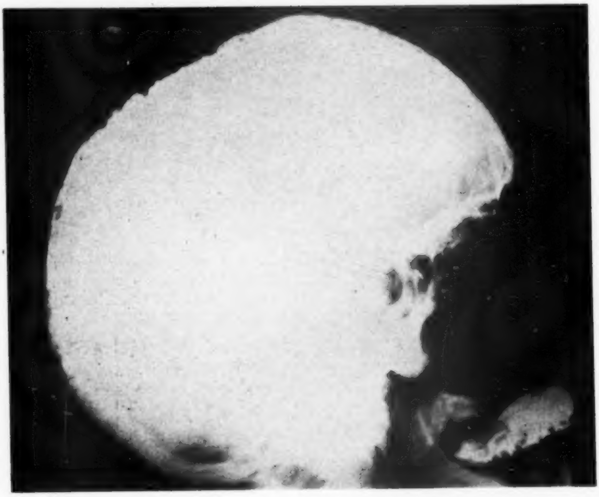


Fig. 324.—Radiogram of the skull showing irregularity and moth-eaten appearance of the outer table of the calvarium, which is characteristic of Paget's disease.

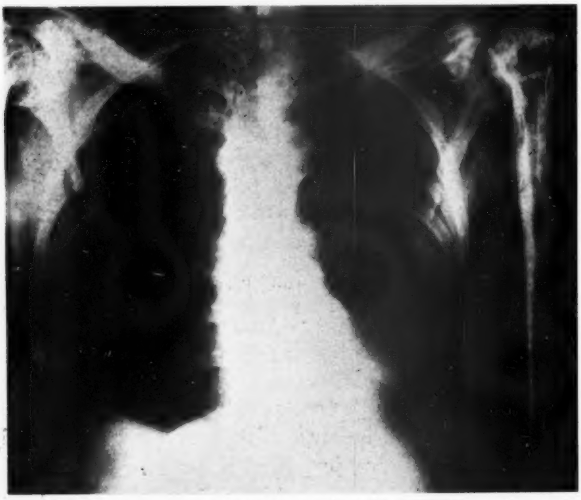


Fig. 325.—Radiogram of the shoulder girdle and chest showing typical appearance of Paget's disease in the upper end of the left humerus. The lesion is more advanced in the head than in the shaft of the humerus. There is also slight thickening of the clavicles.

leg and foot are definitely swollen. There is edema of the right leg and foot.

Temperature 99.5 F. Respiration 84. Pulse 20.

Diagnosis of Paget's disease (osteitis deformans) of the bone was made.

x-Ray report by Dr. Amedee Granger, October 23, 1929—Extensive osteitis deformans (Paget's disease) of the lower end of the femora, skull, ilia, humeri, and tibiae (Figs. 324–327).

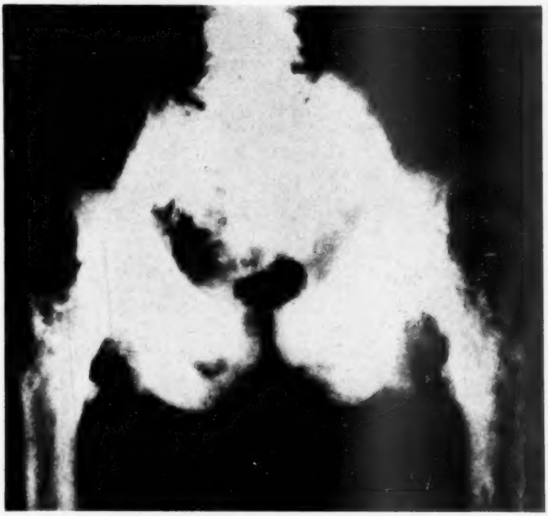


Fig. 326.—Radiogram of the lumbar spine, the iliac bones, and the femora, showing stages of Paget's disease in the femora involving the greater trochanters as well as the heads and necks of the femora. Marked changes in the ilia. Pathologic changes of Paget's disease are seen in the rami of the pubis.

Superimposed upon this condition on the inner surface of the right tibia is a periosteal sarcoma with secondary involvement of the soft parts.

10/30/29: Patient given 5 minims of Coley's toxin, which produced relatively little reaction.

10/31/29: Patient given 7 minims of Coley's toxin with no temperature rise.

11/3/29: Surgical consultation. History of bowing of both legs for ten years associated with pains in legs at night. Since July, 1929, at which time patient fell striking right knee, there has been swelling of knee. Examination reveals very definite enlargement of the cranium, bowing of both tibiae. The right knee and lower half of the thigh are markedly swollen and edematous. The right knee is fixed in a semiflexed position. From the history and *x*-ray findings we believe the patient has osteitis

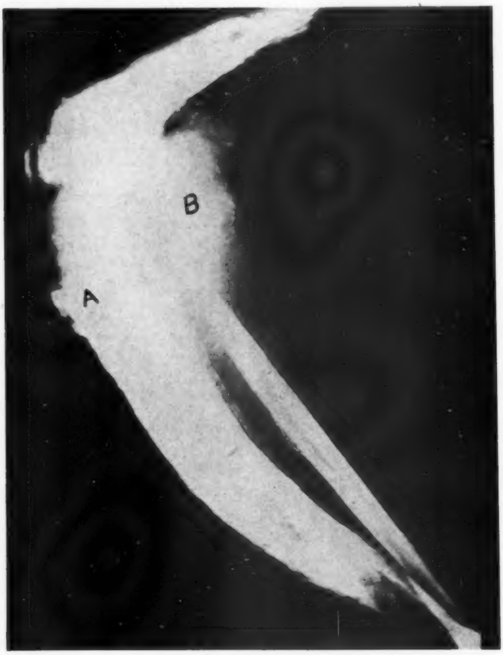


Fig. 327.—Radiogram of the lower third of right thigh, knee joint, and leg, demonstrating characteristic anterior bowing of the tibia, also the absorption of the cortex, with new bone formation and obliteration of marrow cavity. On the anterior surface (*A*) can be seen bone radiating perpendicularly from the cortex of the tibia, which is more or less characteristic of osteosarcoma. At (*B*) the tumor mass is shown filling the entire popliteal space. Marked arteriosclerosis of all vessels is evident.

deformans with osteogenic sarcoma engrafted upon process in the right tibiae. Consider a thigh amputation justifiable as a palliative procedure in order to relieve the patient of pain. Advise transfer to surgery.

11/4/29: Patient given 8 minims of Coley's toxin with no reaction.

11/4/29: *x*-Ray examination of the chest shows no evidence of metastases.

11/9/29: Operation (Dr. Ochsner): Circular "no flap" amputation of the thigh at its midportion without the use of a tourniquet. Spinal analgesia (spinocaine). Patient's postoperative convalescence uneventful. Wound healed by primary intention. Immediately following the operation there was complete relief from pain.

11/25/29: Five minims of Coley's toxin administered intramuscularly, following which patient had slight febrile reaction. Temperature 100 F.

11/28/29: Eight minims of Coley's toxin administered. Temperature rise to 99.5 F.

Patient requested that he be discharged from the hospital on 12/3/29. Instructed to return to the Out-patient Department for subsequent observation.

12/25/29: Patient admitted to the medical service. He states that since he was discharged from the hospital dyspnea has developed, which he attributes to the use of crutches. Otherwise has felt well.

Physical examination shows evidence of acute pulmonary infection. Râles are audible throughout both lungs.

12/29/29: Patient digitalized. Patient's condition becoming rapidly worse.

12/30/29: Patient died.

12/31/29: Autopsy (Dr. J. W. Miller). Peritoneal cavity is negative except for adhesions between the stomach and jejunum and liver. The left lobe of the liver is necrotic and adherent to stomach. Omentum adherent to the stomach. Mesenteric lymph nodes are enlarged, caseous, and fibrotic.

Right pleural cavity contains 500 cc. straw-colored fluid.

Many small nodules of varying sizes found in the pleura. Left pleural cavity contains no fluid, but numerous flat, thin nodules, 1 to 1½ cm. in diameter, are found scattered over the visceral pleura.

Pericardial cavity contains 50 cc. straw-colored fluid. The pericardium is smooth and glistening. The outer layer is infiltrated with a pearl-gray tumor mass, particularly on the mediastinal side. The heart weighs 410 Gm. and shows evidence of myocarditis.

The right lung weighs 380 Gm. It is collapsed against the mediastinal wall. It shows a large number of pearl-gray nodules varying in size from 5 to 10 cm. in diameter. The left lung weighs 470 Gm. It shows a number of nodules in the visceral pleura.

Liver weighs 2190 Gm., is light yellow-brown in color. Right lobe has typical nutmeg appearance. In its substance a yellow tumor, 2 cm. in diameter, is found. The entire left lobe is composed of an infiltrative tumor mass.

The right leg has been amputated at the midportion of the thigh.

Anatomical Diagnosis: Sarcomatous metastases to lung and liver, mesenteric lymph nodes, mediastinal lymph nodes. Myocarditis. Chronic nephritis. Paget's disease. Pleurisy with effusion.

Microscopical Examination: Sarcomatous metastases in the pleura. Many isolated neoplastic cells with lymphocytes and red blood cells are found in the alveolar spaces.

Liver: Metastatic sarcoma, pseudo-encapsulated. Surrounding liver tissue shows passive congestion and granular degeneration of liver cells.

Lymph nodes: Metastatic sarcoma infiltrating lymph structures.

*Description of Amputated Extremity.**—The specimen consists of the lower third of femur, knee, leg, and foot which has been bisected longitudinally.

Gross Description.—The diameter of the lower end, the midportion, and the upper end of the tibia in the region of the tibial tubercle are 8, 13, and 14 cm. respectively. There is marked anterior bowing of the tibia (Fig. 328).

---

* The authors are indebted to Dr. Rigney D'Aunoy, Director of Laboratories, Charity Hospital, for his kind permission to study the specimen.

In the upper end of the tibia for a distance of 11 cm. the normal anatomical relationships of the bony structures are completely destroyed by a new growth, which has all the characteristics of a malignant neoplasm. The neoplasm has completely surrounded the upper end of the tibia, destroyed the cortex, infiltrated the contiguous structures, and is limited from perforating the external surface of the leg only by the skin. That part of the tumor occurring in the popliteal space is of soft consistency, whereas that part occurring on the anterior part of

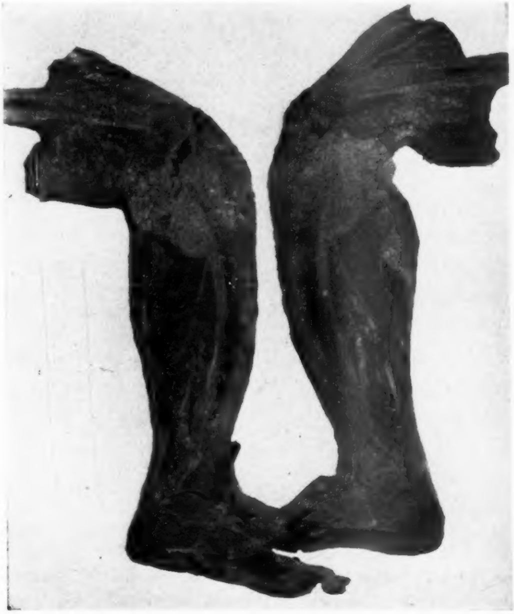


Fig. 328.—Photograph of the bisected specimen showing the relationship of the tumor to the knee joint and the upper end of the tibia and popliteal space. There is resorption of old bone associated with new bone formation producing a thickening of the anterior portion of the cortex of the tibia.

the tibia shows different degrees of hardness and grating when cut with the knife. This is due most probably to the deposition of calcium salts in the neoplasm. The entire neoplasm seems to be pseudo-encapsulated, which is more evident in the popliteal space (Fig. 328).

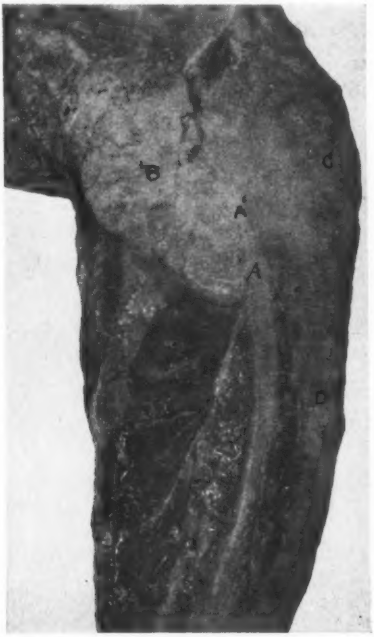


Fig. 329.—Photograph of the upper end of the tibia, including the knee, showing the tumor. At *A* the cortex of the tibia is seen penetrating the tumor for some distance. The neoplasm apparently takes origin from the endosteal as well as the periosteal surface (A^1), producing a fan-shaped appearance at this point. *B* shows the tumor filling the popliteal space. The tumor has perforated the cortex of the tibia. It has almost perforated into the joint, being separated by a very thin strip of articular synovial membrane. At *C* the tumor has destroyed the anterior cortex of the tibia and is denser than at *B*, showing evidence of osteosclerosis. At *D* characteristic changes of osteitis deformans are visible, *i. e.*, resorption and new bone formation with thickening of the cortex.

The remaining portion of the shaft of the tibia is markedly thickened. This thickening is prominent in the cortex which is about twice the normal. The cortex encroaches upon the medullary cavity to such a degree that in places it is almost obliterated (Fig. 329). This increase in thickness is due largely to new bone formation. There are also present in the cortex areas of absorption, the bone being replaced by tissue of soft consistency resembling granulation tissue. Areas in the cortex in which the compact bone is surrounded by granulation tissue and new osseous tissue resemble sequestration. The different lesions observed in the cortex give to the bone a "moth-eaten" appearance, *i. e.*, areas of great density associated with areas of less density. The joints appear normal, except the knee joint, which is almost perforated on the tibial side by the new growth.

Diagnosis from Gross Pathology.—Osteosarcoma and osteitis deformans of right tibia.

Microscopical Description.—Sections from different parts of the tumor were fixed in Zenker's fluid and decalcified. Study of these sections reveals embryonic cells in different stages of maturation. In some of the sections the cells are very embryonic and the intercellular substance is scant, whereas in other sections the cells approach the adult type. In the latter the intercellular matrix is fibrillar, hyaline, and cartilaginous. In some areas new bone formation is evidenced by calcific deposits and bony trabeculae (Figs. 330, 331).

Different degrees of necrosis are present in various sections and occur in those portions of the tumor in which the cellular constituents are more embryonic.

The tumor cells vary in size and shape. They may be polyhedral, rounded, or spindle shaped. The size of the cell also varies considerably from true tumor giant cells to small spindle cells. The nuclei of the majority of the cells are hyperchromatic and very active proliferation is shown by numerous mitotic figures. The different types of cells are shown in Fig. 332.

Nodules removed from the liver, lungs, and peribronchial lymph nodes near the hilum of the lung show the same type cells morphologically as those found in the primary tumor of the tibia. In the lymph nodes, the lung, and the liver the cells are embryonic

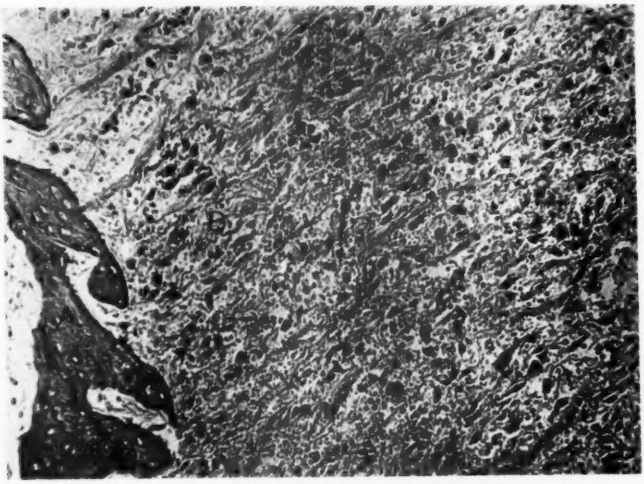


Fig. 330.—Photomicrograph (160 ×) showing tumor tissue (*B*) originating from the endosteum of the cortex (*A*). The fibrillar intercellular substance is evident.

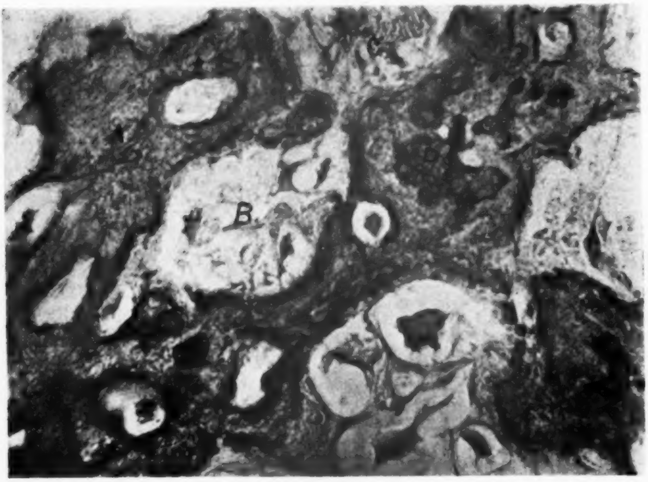


Fig. 331.—Photomicrograph (800 ×). Section taken from the sclerosed part of the tumor showing the formation of bone trabeculae (*A* and *B*). Calcification has taken place at *D*. At *B* and *C* the formation of lacunae is well demonstrated, the lacunae being filled with granulation tissue (*C*).

in type, do not show such marked pleomorphism, and the intercellular substance is fibrillar. There is no bone formation in the metastatic nodules.

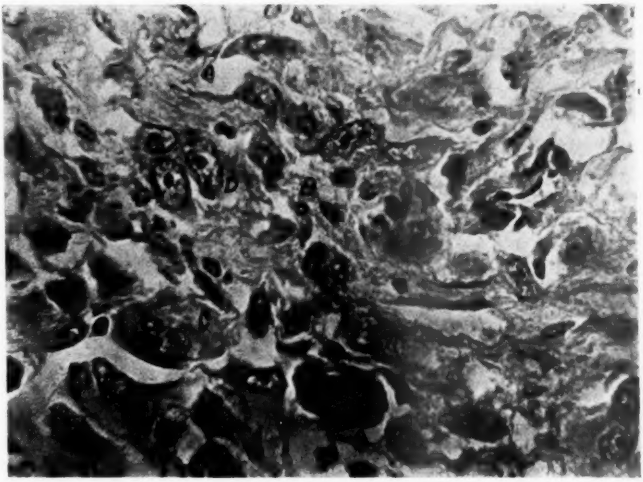


Fig. 332.—Photomicrograph (800 ×) showing typical histopathology of actively growing part of the tumor. The characteristic cells are seen at *D* and *C*. The intercellular substance is homogenous, also fibrillar in type. Mitotic figure is shown at *A*. The cells range from true giant cells (*C*) to almost spindle cell types. This variation in size and shape of cells is frequently seen in osteogenic sarcoma.

Diagnosis from Microscopical Examination.—Osteogenic sarcoma of the tibia with metastases to the lungs, liver, and peribronchial lymph nodes superimposed upon osteitis deformans.

DISCUSSION

We were able to collect from the literature 31 cases of sarcoma developing in lesions of osteitis deformans. In addition to these 31 cases, 8 other cases were found in which the diagnosis was questionable, either because insufficient data were given in the report or because the presence of a malignant tumor was not definite. Of the 31 cases collected the age was stated in 27 and not given in 4. Of the 27 cases in which the age was given, the oldest was seventy years (Camp[14]), and the youngest was thirty-six years (Bird[9]). Only 3 patients were younger than forty years (11.11 per cent); 7 patients were from forty-one to fifty years of age (25.9 per cent); 9 from fifty-one to sixty years (33.33 per cent); 8 from sixty-one to seventy years (29.4 per cent). The average age for the entire series was fifty-four years.

The sex of the patients was stated in 28 cases. The condition occurred in 24 males (86 per cent) and in 4 females (14 per cent).

In the majority of cases only one bone was involved by the malignant process. A malignancy occurring in several bones simultaneously was found in cases reported by Bird[9]; Gruner, Scrimger, and Foster[12]; Heazlit[16]; von Kutscha[17]; Wherry[18]; Fedder.[19] An analysis of the reviewed cases shows a localization of the malignant process in osteitis deformans as follows: The humerus was the site of the malignant process more frequently than any other bone. It was involved in 9 cases (Paget[1] 1; Bird[9] 3; Camp[14] 1; Gruner, Scrimger, and Foster[12] 1; Martens[20] 1; Heazlit[16] 1; and Fedder[19] 1). The skull was involved with the malignant process in 7 cases (Bird[9] 3; Packard, Steele, and Kirkbridge[2] 1; Gruner, Scrimger, and Foster[12] 1; von Kutscha[17] 1; Wherry[18] 1). In 6 cases the femur was involved (Bird[9] 1; Speiser[4] 1; Cabot[21] 1; Camp[14] 1; Sippel[22] 1; Heazlit[16] 1). The tibia was involved also in 6 cases (Ransohoff[23] 1; Howse[24] 1; von Kutscha[17] 1; Wherry[18] 1; Heazlit[16] 1; the authors' case). The ilium was involved four times (Bird[9] 2; Fedder[19] 1; Fielder[25] 1). The radius was involved three times (Paget[1] 1; Gruner, Scrimger, and Foster[12] 1; Heazlit[16] 1). The sacrum was involved twice (Fedder[19] 1 and Fielder[25] 1). The clavicle was involved with malignant process twice (Bird[9] 1; Gruner, Scrimger, and Foster[12] 1). Involvement of the scapula was reported by Bird,[9] and a similar case in which the maxilla was involved was reported by Wanke.[15]

The treatment which was introduced in the various cases was manifold. In 11 cases amputation was resorted to (3 of Bird's[9] cases; Wanke[15]; Segale[11]; Speiser[4]; Ransohoff[23]; Paget[1]; Howse[24]; Gruner, Scrimger, and Foster,[12] and the authors' case). Irradiation was the treatment employed in 5 cases (4 of the cases reported by Bird[9] and 1 of the cases reported by Camp[14]). Coley's toxin was employed in 2 cases (Heazlit[16] and the authors' case). Curettage was performed in 2 cases (Bird[9] and Heazlit[16]). Local extirpation of the lesion was performed in one of Bird's[9] cases.

The prognosis in osteogenic sarcoma developing in lesions of osteitis deformans is invariably poor as evidenced by the mortality rate. Of the 31 cases collected from the literature all but one succumbed within a few months, irrespective of the type of therapy. In Bird's[9] Case III the end-result was not known, so that it is not possible to say whether this patient died or not. In spite of the very grave prognosis, we feel that especially in those cases in which there is considerable pain as a result of the malignant process an amputation of the involved extremity is justified. In our own case even though the patient died within a few weeks after the performance of the amputation, he was free from pain which for several months previously had been so severe that he had been unable to rest.

BIBLIOGRAPHY

1. Paget, J.: On a Form of Chronic Inflammation of Bones (Osteitis Deformans), Med. Chir. Trans., London, 60, 1877. Abs. by Speiser, Virchow's Archiv. f. Path. Anat. u. Physiol., 119, 542. Abs. by Speiser, Idem: Some Rare and New Diseases, Brit. Med. Jour., 2, 1189, 1882. Idem: Remarks on Osteitis Deformans, Illus. Med. News, 2, 181, 1889.
2. Packard, F., Steele, J. D., and Kirkbridge, T. S.: Osteitis Deformans, Amer. Jour. Med. Sci., 122, 552, 1902.
3. Williams, W. R.: The Nature of Osteitis Deformans (Paget), and Its Relation to Malignant Neoplasia, Lancet, 2, 1543, 1909.
4. Speiser, F.: Sarkomatöse Entartung bei Ostitis deformans, Arch. f. klin. Chir., 149, 274, 1928.
5. Milieki: Quoted by Speiser.
6. Codman, E. A.: Quoted by Kolodny.
7. Kolodny, A.: Bone Sarcoma, Chicago, Surgical Publishing Company, 1927.
8. Higbee, W. S., and Ellis, A. G.: A Case of Osteitis Deformans, Jour. Med. Research, 24, 43, 1911.
9. Bird, Clarence E.: Sarcoma Complicating Paget's Disease of the Bone, Arch. Surg., 14, 1187, 1927.
10. Gross, S. W.: Sarcoma of the Long Bones Based on a Study of 165 Cases, Amer. Jour. Med. Sci., 78, 2, 1879.
11. Segale, G. C.: Osteite deformante del Paget con sarcoma dell'omero, Archiv. Ital di Chir., 22, 482, 1928.

12. Gruner, O. C., Scrimger, F. A. C., and Foster, L. S.: A Clinical and Histological Study of a Case of Paget's Disease of the Bones with Multiple Sarcoma Formation, Arch. Int. Med., 9, 641, 1912.
13. Cone, S. M.: The Pathology of Osteitis Deformans, Paget's Disease, Jour. Bone and Joint Surgery, 4, 751, 1922.
14. Camp, J. D.: Sarcoma Complicating Osteitis Deformans: A Report of Two Cases, Radiology, 5, 495, 1925.
15. Wanke, R.: Ostitis fibrosa und sarcom, Deutsche. Ztsch. Chir., 201, 359, 1927.
16. Heazlit, L.: Sarcoma Complicating Paget's Disease of Bone, New York State Jour. Med., 17, 330, 1917.
17. von Kutscha, E.: Beitrag zur Kenntniss der Ostitis deformans (Paget's), Arch. f. klin. Chir., 89, 758, 1909.
18. Wherry, George: Sequel to a Case of Osteoporosis of the Cranial Vault, Brit. Med. Jour., 2, 743, 1896.
19. Fedder, L.: Ostitis deformans mit sekundärer Rundzellensarkomatose, Fortschr. a. d. Geb. d. Röntgenstr., 31, 391, 1923–24, Abs. by Speiser.
20. Martens: Osteodrystrophia fibrosa (Sogennannte Ostitis fibrosa und maligne Neubildung), Berlin Med. Soc., February 10, 1926. Abs. by Speiser in Klin. Wchnschr., vol. 5, 1926.
21. Cabot, R. C.: A Case of Spontaneous Fracture of the Hip (Case 121513), Boston Med. and Surg. Jour., 195, 1215, 1926.
22. Sippel, P.: Ueber einen Fall von Ostitis fibrosa deformans mit ausgedehnten Knochentumoren, Arch. f. Gynaek., 103, 107, 1914.
23. Ransohoff, J.: Osteitis Deformans, Central Sarcoma, Streptococcus Infection, Lancet-Clinic, 110, 672, 1913.
24. Howse, H. G.: Hyperostosis of the Tibia, Associated with Curvature of the Shaft (Osteitis Deformans) and the Development of a Spindle Celled Sarcoma in the Upper Epiphysis, Trans. Path. Soc., London, 29, 182, 1877. Abs. by Speiser.
25. Fielder: Osteitis Deformans, Lancet, 1, 1428, 1896.

CLINIC OF DR. J. M. MASON

St. Vincent's, The Hillman, and the Children's Hospitals,
Birmingham, Alabama

HERNIA

A series of rather interesting hernias has just passed through my hands and is made the subject of this report. They are as follows:

Two obstructed right scrotal hernias in infants.
Two postoperative ventral hernias.
One femoral bladder hernia.
One epigastric hernia.

INGUINAL HERNIA IN THE INFANT

If small in size when treatment is undertaken, hernia in infants is often cured by a truss. However, we frequently encounter those which have become obstructed and which require operative relief to prevent obstruction from reaching the stage of actual strangulation.

The dangers of prolonged taxis are well understood. Many obstructed hernias will reduce themselves, or can be reduced with a small amount of manipulation under anesthesia. Unless there is definite contra-indication to operation, such hernias should be subjected to radical operation at once, since incarceration and possibly strangulation are likely to recur at any time. If there is some definite contra-indication, the child should be operated on as soon as the contra-indication has been removed.

EPIGASTRIC, FEMORAL, AND BLADDER HERNIAS

A discussion of epigastric and femoral hernias, and especially of bladder hernias, would prove of great interest, but space does not permit us to undertake it here. A very clear and complete review is found in Watson's book "Hernia," which I commend to any who may wish to follow up these subjects.

POSTOPERATIVE HERNIAS

There are four main causes for the development of such hernias:

1. Drainage operations, which interfere with complete reconstruction of the abdominal wall.
2. Inefficient closure of the abdominal wound, such as is brought about by the use of "through and through" sutures which do not approximate the different anatomical layers of muscle and fascia; or by the use of suture material which is too soon absorbed, allowing the abdominal muscles to be stretched and separated before firm union has taken place.
3. Suppuration in the wound which destroys the integrity of a proper closure.
4. Destruction of nerve supply to the muscles of a given part, resulting in atrophy and weakness of the muscles involved.

In the first class hernia is unavoidable; in the other classes hernia is largely preventable.

These hernias were operated on in three hospitals, but will be reported together for better coordination.

Case I. Obstructed Hernia, Right Inguinal, Colored Infant Four Months of Age.—W. M., colored male, aged four months, was admitted to the Surgical Service of the Hillman Hospital at 6 P. M. January 24, 1930, for relief of irreducible right scrotal hernia. The mother stated that she had only noticed the hernia at noon, and that the baby had been in previous good health.

Examination revealed a well-developed and nourished infant with a large scrotal hernia on the right side. The tumor was very hard and irreducible with ordinary measures. The child was very restless and fretful and screamed with pain on the slightest manipulation. There was no vomiting after his admission to hospital and an enema resulted in a good bowel movement. General physical examination revealed no other abnormality.

Operation.—Ether 7.20 to 8 P. M.

Radical operation with high ligation of the sac, and transplantation of the cord. Bassini technic.

The deep sutures uniting the conjoined tendon to Poupart's ligament were of No. 1 plain catgut, three in number. The fascia was united with a continuous suture of the same material, and the skin was approximated with interrupted sutures of black silk. The wound was dressed with gauze and cotton sealed over with collodion, reinforced by a spica of the groin.

Spontaneous reduction of the hernia occurred during operative manipulation after the child was under the anesthetic, but it was considered wise to complete the radical operation on account of the size of the hernia and of the certainty of its return to the scrotum when the child began to cry or struggle.

Since the incarcerated intestine was reduced before the sac was opened we had no opportunity of inspecting the bowel, but the presence of bloody fluid in the sac indicated to us that there was beginning strangulation. However, the short time that the hernia had been obstructed made us feel quite safe regarding the integrity of the bowel wall.

The infant had quite a high reactionary temperature, due to several factors; ether proved irritating to the respiratory tract though no consolidation developed; malnutrition and, for a time, dehydration were contributing factors; marked edema of scrotum and induration of the testicle developed, but the wound healed by first intention.

The bowels moved promptly and regularly after operation, showing that the bowel wall had not been injured and that obstruction had been relieved.

The patient left the hospital on February 8th, the fifteenth postoperative day, with wound soundly healed.

Case II. Right Inguinal Hernia, Congenital, Obstructed.—J. D. C., white male, aged eight months, was admitted to the Surgical Service of the Children's Hospital at 8 P. M., March 27, 1929, for the relief of a scrotal hernia which had become irreducible.

The mother stated that the hernia was noticed when the child was three months of age, and that it had increased materially in size, but had given no trouble and had been reducible until late in the afternoon of the day of admission, since which time the child had given evidence of acute suffering.

Examination showed a well-developed male infant with normal heart and lungs and without elevation of temperature.

A large scrotal hernia was present on the right side, also a small umbilical hernia.

The child cried a great deal, and was restless, but had not vomited. The hernia was very hard, and manipulation seemed to cause great pain. Operation was decided on.

Operation.—Ether 8 P. M.

While the superficial tissues were being incised, the hernia became reduced, but it was considered advisable to proceed with the radical operation on account of the large size of the hernia.

The Bassini operation was performed, using three No. 1 ten-day chromic catgut sutures to unite the conjoined tendon to Poupart's ligament, and plain catgut for the more superficial layers, approximating the skin edges with interrupted sutures of black silk. There a considerable postoperative rise of temperature for three or four days, due in part to bronchial irritation and partly to edema of the scrotum. This latter is a not infrequent accompaniment of hernia operations in infants, but usually subsides very soon and did so in this instance, with healing of the wound by first intention. He was discharged on April 6th, the ninth day after operation.

The dressing in this instance was of gauze covered with cotton sealed over with collodion, and reinforced with spica of groin.

Case III. Hernia Following Drainage Operation for Removal of Gangrenous Appendix.—Ordinarily the hernias which appear in the drainage tract of cases of appendicitis operated on by the gridiron method are small and give so little trouble that operation is seldom necessary. Usually the hernial opening is plugged with omentum and at other times the cecal wall or some other part of colon which is rather fixed may protrude through the opening. These structures having much less mobility than small intestine, rarely give rise to painful or obstructive symptoms. When ileum enters the hernial sac and becomes attached to the margins, obstruction may develop; or, if this does not take place, the patient often suffers such discomfort that operation is sought. The latter condition developed with this patient.

F. J. V., white male, married, aged fifty-one, was operated on by me in August, 1928, for removal of a gangrenous appendix on the third day of the attack. One cigaret drain was employed. He had a stormy convalescence, but finally made a complete recovery, and has remained well. A small hernia developed at the site of the drainage tract, but it showed no tendency to become larger and only within the past few months has it given trouble.

Since this time there has been so much dragging pain in the region of the scar that he decided that he would submit to operation. He was admitted to the surgical service of St. Vincent's Hospital on February 9, 1930, and was operated on the following morning.

Operation.—Local anesthesia, infiltration, with 0.5 per cent novocaine.

1. The scar from the appendix operation was excised and the peritoneum opened. A small knuckle of ileum was found in the sac, tightly attached around the margin of the opening.

2. The intestine was freed with considerable difficulty; bleeding points were ligated with fine black silk and denuded areas were covered over with Lembert sutures of the same material.

3. The area of peritoneum adjacent to the old operative site and the abdominal viscera in this region were from adhesions other than those about the knuckle of ileum. When the ileum had been completely freed and the denuded surfaces satisfactorily covered, it was returned to the abdomen and the wound was closed in layers. No. 2 forty-day chromic catgut was used for the deeper layers; No. 1 ten-day chromic for fascia, with three reinforcing silkworm gut sutures through skin and external oblique fascia, and black silk for the skin.

Recovery was uneventful and he was allowed to leave the hospital on the fifth day, but was kept in bed at home for another week, after which he has been allowed to be out of bed about the house, and resumed his duties on February 25, sixteen days after operation.

He has been entirely free from discomfort since the ileum was freed from its adherent position in the hernial sac.

Case IV. Abdominal Hernia, Postoperative, Following Pelvic Operation. Twenty Years' Standing.—This case is reported on account of the unusual hernial sac which was found at operation.

Mrs. C. B., white female, married, multipara, aged fifty-two, underwent a midline pelvic exploration about twenty years ago. As nearly as I can gather from the history, the wound was closed with "through-and-through" silkworm gut sutures. Apparently the wound was not drained. About two years after the operation she noticed a small protrusion through the central part of the scar. This steadily increased in size, and at the time she consulted me, the hernia was one of large proportions. There was much dragging pain in the pelvis and in the back. Such abdominal supports as she had used had not held the hernia in reduction and she thought that it was gradually increasing in size.

She claimed that it was reducible when she was on her back and manipulated it for a considerable time.

Examination showed a short stout woman of middle age, with fat abdominal wall and a large hernia in the midline below the umbilicus. The hernial opening was near the centre of the scar and was not large. The margins were well outlined, and the protrusion presented a bilocular appearance. The lower division was about the size of a grapefruit and hung over the pubis when the patient assumed the upright position. Above and to the left was another pocket which seemed to project into the left loin for a distance of 6 inches or more. The contents of the larger compartment could be easily reduced, but I was never able to reduce the smaller compartment.

The patient had a much relaxed vaginal outlet with cystocele and rectocele, and had suffered considerably from cystitis. There were shadow suspicions of a stone in the right ureter, but cystoscopy with attempted ureteral catheterization was unsuccessful in making certain diagnosis. After the administration of urinary antiseptics the bladder symptoms cleared up. The physical examination revealed no further points of interest.

She entered the Surgical Service of St. Vincent's Hospital on February 3, 1930, and was operated on the following day.

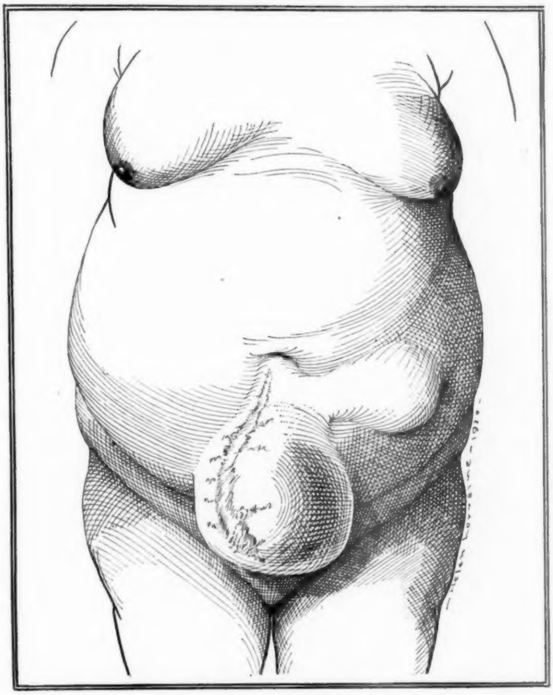


Fig. 333.—Illustrating the general appearance of the abdominal hernia in Case IV.

Operation.—Ether.

The old scar was excised, the peritoneal cavity opened, and the hernial sac examined. These steps of the operation were very tedious on account of the large amount of fat present and the considerable amount of bleeding from small vessels. The opening between the muscles was oval in shape and measured approximately $1\frac{1}{2}$ by 3 inches. The lower compartment of the sac was globular, lined throughout with peritoneum, was filled with omentum and intestines and was entirely free from adhesions.

The contents of this sac was reduced and the other compartment was investigated. At the upper and outer aspect of that part of the abdominal wall adjacent to the scar a pocket had been burrowed in the fat, between the skin and the fascia. This was about 5 inches in depth and approximately 2 inches in diameter.

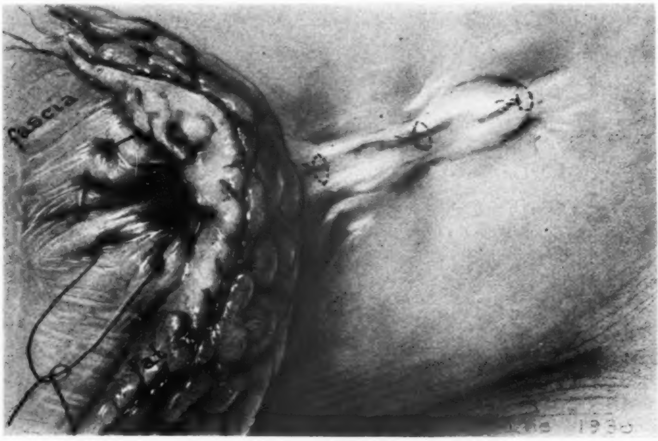


Fig. 334.—Illustrating the method of obliterating the smaller cavity of the abdominal hernia in Case IV.

It was lined with peritoneum, contained omentum and small intestines, and was free from adhesions. After untwisting the mass, the hernia was readily reduced.

Inspection of the entire hernia now showed its relations.

The deep layers of the upper and lower aspect of the abdominal incision were firmly united, but just above the center of the incision the muscles were separated, allowing the viscera to escape. The hernia had developed two distinct compartments, the larger one extending down over the pubis and the other into the loin as already described.

The question of obliteration of the smaller cavity presented itself, and we decided that this could be accomplished by the use of several layers of purse strings, closing the pocket from the bottom. This was done with complete success.

The rest of the operation consisted simply in separating the muscular layers of fascial places, trimming away redundant skin and fat, and reconstructing the wall.

Catgut, silkworm gut, and silk were the suture materials employed. The after-treatment was complicated by considerable oozing from small vessels, and by acute infection of the superficial fat layer. This subsided in a very few days, and the integrity of the deeper layers was not impaired. She was discharged on February 27th, with the wound soundly healed, and with a firm abdominal wall.

Case V. Femoral Hernia of Bladder.—E. M., white male, married, aged forty-two, street railway conductor, consulted me on December 21, 1929, on account of a painful swelling in the right groin. He stated that the swelling had been noticed a year previously, but that it had given no trouble until he sustained a bruise in this region on December 19th. Since that time he had been conscious of it at all times and the pain seemed to be increasing. He also complained of some bladder irritation with increased frequency of micturition.

Examination revealed a soft, dull, irreducible swelling over the femoral ring, approximately 1½ inches in diameter. The urine contained only a faint trace of albumin and a few leukocytes. The diagnosis of femoral hernia was readily made and the necessity for operative relief was explained.

In my practice femoral hernias have rarely presented themselves until some symptoms of strangulation have developed, hence I was interested to learn that there had been no intestinal disturbance and no suggestion of obstruction, although he was having considerable pain. The findings at operation explained this.

He was admitted to the Surgical Service of St. Vincent's hospital on December 26, 1929, and was operated on the following day.

Operation.—Local anesthesia, infiltration with 0.5 per cent novocaine.

1. Vertical incision over the tumor, with clearing away of all subcutaneous tissues to the hernial protrusion and freeing this to the neck.

2. Only a small, very thin and incomplete peritoneal investment was found, showing that the hernia had emerged from the abdominal cavity almost extraperitoneally. This condition is not infrequent in inguinal bladder hernias and has been observed in femoral bladder hernia.

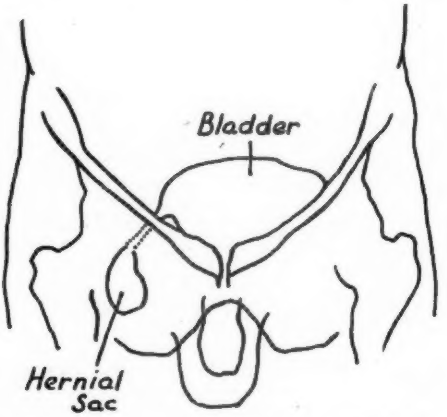


Fig. 335.—To illustrate, diagrammatically, the development of a femoral bladder hernia—Case V.

While we had not made a preoperative diagnosis of bladder hernia, we were not unaware of such a possibility and when we encountered a mass of lemon-colored prehernial fat, which is one of the most striking features of the bladder when it presents in a hernia, we felt quite certain that we were dealing with the bladder.

3. The constricting ring was now incised to allow of further

withdrawal and manipulation of the hernia, and after careful packing off to prevent any possible contamination, the hernial protrusion was opened. On exploration we found that the hernia consisted of projection of the bladder of about 5 cc. capacity. Figure 335 represents schematically the development of this type of hernia.

4. Treatment of the incised bladder: As every precaution had been taken against soiling the operative field, we saw no reason for not effecting a tight closure, hence the bladder was sutured in three layers, the first two of catgut, and the last one of interrupted silk, this tier involving only outside structures overlying the bladder wall. The mass was then replaced in the abdomen, the general peritoneal cavity not having been opened.

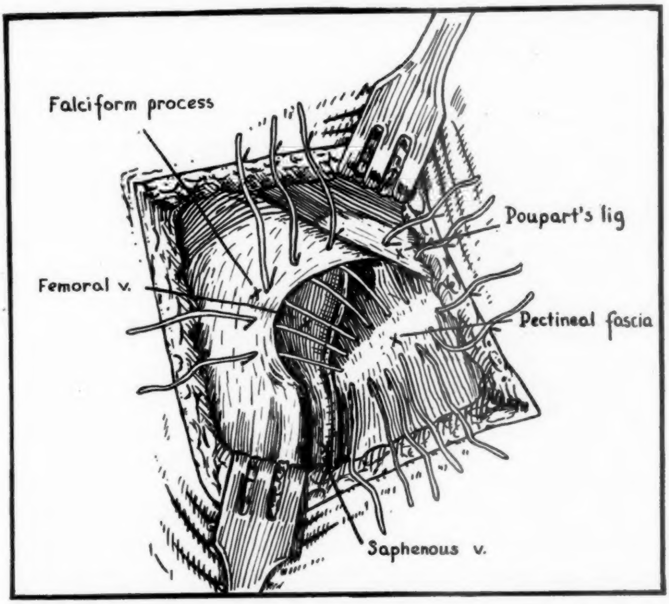


Fig. 336.—The Bassini method of closure of femoral hernia employed in Case V.

5. The femoral ring was closed by interrupted sutures according to the method of Bassini, the skin and subcutaneous

tissues were approximated with catgut, silkworm gut, and silk. The method is illustrated in Fig. 336.

His recovery was uneventful, the incision into the bladder giving rise to no symptoms, and urinalysis the day following operation showed: Specific gravity 1.018, acid, albumin 5 mg. per 100 cc., an occasional granular cast, a few leukocytes, and 2 or 3 red blood cells per low power field.

He was discharged from the hospital on January 8, 1930, and was allowed to resume his work one month after operation.

Diagnosis of Bladder Hernia.—Unless bladder symptoms have been sufficiently marked before operation to justify special cystoscopic investigation, it is unlikely that a definite preoperative diagnosis will be made, but one should always bear in mind the possibility of bladder hernia, and be able to recognize the characteristic appearance of this organ. Watson says that "the bladder may be recognized by the yellow prehernial fat, or by the deeper color of the bladder wall, and the increased number of tiny blood vessels in its surface." He analyzed 347 cases of bladder hernia in regard to time of diagnosis in relation to operation with the following findings:

Diagnosis:

Before operation	25
During operation	279
After operation	43
	347

the seriousness of the second class depends on whether or not

Needless to say the last class carries a high mortality, while the bladder was opened; if opened, whether accidentally or intentionally, and, in either event, whether it was satisfactorily repaired.

Case VI. Epigastric Hernia.—E. W., colored male, truck driver, aged twenty-nine, consulted me on February 1, 1930, complaining of pain after eating, a dragging sensation in the upper abdomen, and of tenderness over a small area above the umbilicus. He attributed his trouble to having been struck in the "pit of the stomach" by a jack handle while working on his truck some five or six weeks previously.

The patient was a very muscular man of medium build with history of good health except for occasional attacks of asthma. His general physical examination revealed nothing except the epigastric tumor, and a few sibilant râles due to the asthmatic condition.

About 3 inches above the umbilicus, in the linea alba, was found a definite mass approximately $1\frac{1}{2}$ inches in circumference, irreducible, rather firm, and slightly tender. A diagnosis of epigastric hernia was made and he was advised of the necessity of operation.

He was admitted to St. Vincent's Hospital on February 7, 1930, and was operated on the following day.

Operation.—2/8/30. Local anesthesia, 0.5 per cent novocaine. Infiltration.

1. Three-inch vertical incision over the tumor, clearing the subcutaneous tissues from the hernia and exposing the fascia.

2. The margins of the constricting ring were cut above and below the protrusion, and the fascia was divided for about 1 inch above and below the ring. This permitted the freeing of the hernia and examination of its component parts.

3. Properitoneal fat formed the bulk of the hernial mass, but on freeing this a definite sac presented. This was opened, but was found to be empty. On the right margin a process of the falciform ligament of the liver entered the sac and was adherent to the wall. The sac was cut away and the opening closed with catgut.

4. Treatment of the fascia. This is the most important step in the operation, and overlapping makes recurrence very unlikely if primary union is obtained.

The fascia which had previously been freed to permit of this procedure, was overlapped and sutured with No. 2 forty-day chromic catgut. The closure was further strengthened by three silkworm gut sutures passed through the skin, subcutaneous tissues and fascia. The skin was approximated with black silk.

5. The patient was kept in bed for two weeks and will not

be allowed to resume his duties for one month from date of operation.

Comment.—The influence of his alleged injury in the production of the hernia is doubtful. It is much more likely that his laborious occupation, necessitating frequent strains with increased intra-abdominal tension, brought about the condition than that it followed a blow on the abdomen from the outside. Asthma may also have been a contributing factor. It is probable that the hernia was already present, unnoticed, and that the blow increased the sensitiveness of the region, and drew his attention to its presence. This was the case in the femoral hernia previously reported.

INTUSSUSCEPTION

The etiology and symptomatology of this condition are so well understood that the present case needs no special comment. It was typical in every respect except that no mass could be detected. At operation this was found to be due to the location of the tumor, high in the right upper abdomen, and obscured by the overlying liver.

Case Report.—*History.*—A. E. C., Jr., white male, age six months, was admitted to the Surgical Service of the Children's Hospital with the following history: At 6.15 P. M., September 20th, the child, previously healthy, began to scream and refused all food. The mother gave an enema and a bloody stool resulted. The baby was restless all night, but the screaming ceased and there was less evidence of extreme pain. Another enema was given in the morning, resulting in another stool consisting mostly of bloody mucus. Dr. H. B. Kennedy of the Pediatric Service saw the child at 12.30 P. M. on September 21st, made a diagnosis of intussusception, and sent the patient to the hospital where we examined him together at 1.30 P. M. There were vomiting, constipation, bloody mucous stools, moderate distention, no rigidity, no mass to be detected either on abdominal palpation or rectal examination. The examining finger was covered with blood-stained mucus on withdrawing it from rectum. The child looked acutely ill and depressed.

The diagnosis was concurred in and operation was done at 2.20 P. M., twenty hours after onset of symptoms.

Operation.—Ether 2.20 to 3.20 P. M.

1. Right rectus incision, with exploration, first of right iliac fossa and region adjacent to normal position of cecum. The cecum was not found here and the incision was extended upward and a large mass was located high up under the liver. This accounted for our inability to locate the mass by palpation before operation.

2. The mass. This consisted of an ileocecal intussusception involving two thirds of the appendix, several centimeters of terminal ileum, and part of the cecum, the whole making a tumor approximately 2 by 3 inches in size.

3. The intussuscipiens was withdrawn, the appendix was removed, and an extensive Lane kink divided. The distal third of the appendix showed beginning gangrene and there was a definite line of demarcation where strangulation had taken place.

4. The abdomen was closed in layers.

The child left the operating table in severe shock and required much stimulation. The convalescence was complicated by prostration and vomiting, the latter being due to acute dilatation of the stomach or to partial obstruction. This was finally relieved by prolonged and repeated lavage. There was primary union in the wound and the child left the hospital well on October 3d, twelve days after admission.

The noteworthy features of this case were:

The typical history; the presence of a large tumor which we were unable to locate before operation on account of its position, and the successful use of lavage for relief of postoperative vomiting.

PREPARATION OF THE JAUNDICED PATIENT FOR OPERATION ON THE BILIARY TRACT; CHOLECYSTOSTOMY WITH REMOVAL OF STONES FROM GALLBLADDER AND CYSTIC DUCT

THE presence of jaundice in any contemplated operation on the biliary passages adds greatly to the dangers. The chief of these are marked tendency to hemorrhage and impairment of the glycogenic function of the liver. Obstruction must be relieved and drainage must be established. Choledochotomy and cholecystostomy usually accomplish these results, but, in certain instances of unreliable obstruction, cholecystogastrostomy or cholecystenterostomy may become necessary.

Cholecystectomy in the presence of jaundice is a questionable procedure, usually contra-indicated.

A most illuminating discussion of cholecystostomy versus cholecystectomy is found in an editorial by Wm. J. Mayo in Surgery, Gynecology, and Obstetrics, January, 1924, Vol. 38, No. 1.

Two significant passages will be quoted:

"If the infectious process is no longer confined to the gallbladder, but has extended into the common duct, and from there to the hepatic or pancreatic duct, cholecystostomy rather than cholecystectomy is now the logical procedure. If cholecystectomy has not been performed secondary operation on the common duct is comparatively easy; in the absence of the gallbladder it is extremely difficult and dangerous."

"Walters found that a higher mortality followed cholecystectomy with removal of stones from the common duct in the jaundiced patient than cholecystostomy, and that, in 58 per cent of jaundiced patients who died following combined cholecystectomy and choledochotomy, there was too much blood in the peritoneal cavity; not enough always to cause death, but sufficient to be a contributing factor."

Bearing in mind these facts and others of equal importance the following case is reported:

Cholecystostomy for Gallstones Associated with Jaundice.—Mrs. R. R., white female, aged thirty, ii para, was admitted to the Surgical Service of St. Vincent's Hospital on February 9, 1930, with the following history:

She became suddenly ill on January 27th, with a pain under right costal margin extending through to the back. By February 2d the condition had become so aggravated that she was confined to her bed, suffered continuously from nausea and vomiting, requiring much morphia for relief, and had become jaundiced. She was not constipated.

There was no history of previous gallstone attacks or of indigestion. However, she stated that she was nauseated throughout the entire course of her two pregnancies, and that she had been treated by dilatation of the ureter for pain in the right side due to structure of ureter four years ago. Both these matters are significant.

The essential features of her physical examination were: An extremely fat young woman with thick abdominal walls; jaundice; tenderness in right upper quadrant of the abdomen; dry skin and tongue; a normal heart, with blood pressure of 138/82, and pulse of 74; lungs clear throughout; temperature 99.2 F.

Urinalysis: Specific gravity 1.020. Acid. Albumin 10 mg. per 100 cc. No sugar. A few hyaline casts, leukocytes, and red cells.

Blood examinations: Hemoglobin 92 per cent; red cells 4,840,00; leukocytes 10,550; lymphocytes 24 per cent; neutrophils 75 per cent; eosinophils 1 per cent; coagulation time four minutes, 32 seconds; blood Group III; quantitative bile test, Van den Berg, 50 mg. bilirubin per liter.

She was immediately given glucose-soda by proctoclysis, and the following morning was given 350 cc. 10 per cent glucose solution intravenously, followed by 2000 cc. 5 per cent glucose subcutaneously in the course of twelve hours.

On the following day the nausea and vomiting ceased, and she was able to take a considerable quantity of fluid nourishment. On three days preceding operation she was given 5 cc. of 5 per cent calcium chloride intravenously and on the evening before operation received intravenously 1000 cc. 5 per cent glucose solution. She required no more morphine.

During the week of preoperative preparation, dryness of the tongue and skin improved; the urinary output increased; the jaundice remained stationary; and the pain became lessened but did not entirely disappear. Her stools were never clay colored and always presented a normal brownish appearance. The bilirubin fell from 50 to 33.3 mg. per liter, and the coagulation time was reduced from four minutes thirty-two seconds, to three minutes and twenty-three seconds; the temperature remained about normal.

We now considered her condition favorable for operation.

Operation.—February 16, 1930.

Cholecystostomy with removal of stones from cystic duct and gallbladder.

1. Nitrous oxide induction followed by ether.

2. Adequate exposure of gallbladder and ducts was obtained through a Mayo incision and wide retraction.

3. Inspection of biliary tract. We found a gallbladder larger and more distended than is usually encountered in common duct stone, and palpation of the common duct throughout its course failed to reveal any stone unless that one lying deepest in the cystic duct encroached upon or projected partially into the common duct. A nest of small stones was found deep in the cystic duct. An enlarged lymphatic gland was observed near juncture of cystic and common ducts. The cystic duct was opened and cleared of stones and the wound closed with catgut. The gallbladder was then opened and cleared of stones.

4. Cholecystostomy instead of cholecystectomy was decided on for reasons already set forth. One cigaret drain was placed beneath the gallbladder and carried down to the junction of the cystic and common ducts. The gallbladder was drained with a rubber tube held in place with a catgut suture, while the walls

of the gallbladder were inverted around the tube by two purse strings of catgut.

5. Closure of the abdomen: In stout patients this is often a difficult undertaking. In this instance we used interrupted "Figure-of-8" sutures of No. 2 forty-day chromic catgut uniting fascia, muscle, and peritoneum; reinforcing these with interrupted sutures of heavy braided silk passing through all the layers of the abdominal wall; further approximating certain areas of fascia with No. 1 catgut where it seemed that this would add to the strength of the closure, and finally approximating the skin edges with black silk. In stout patients I prefer the use of heavy braided silk to silkworm gut. A single silkworm gut suture will sometimes give way under the effect of postoperative distention or vomiting, while the double suture is bulky and sometimes cuts badly before it has been in place long enough to be safely removed. Heavy silk is more pliable, does not show such a tendency to cut into the tissues, and can remain in place longer without causing irritation.

Postoperative Course.—Reaction was prompt and was associated with only a slight rise of temperature, and with very little nausea. There was no bleeding. The jaundice quickly cleared up. Soft diet was taken on the fourth day. The abdominal drain was removed on the sixth day and the tube was removed from the gallbladder on the eighth day. Bile drainage ceased on the eleventh day. The wound healed by first intention to the point of exit of the drain. She was discharged from the hospital on March 11th, twenty-five days after operation, with only a narrow superficial drain tract extending through the abdomen which was to be dressed by her home physician until entirely healed.

The smoothness of her convalescence is largely attributable to the preparatory measures employed in the week preceding her operation.

ABSCESS OF THE RIGHT FRONTAL LOBE OF THE BRAIN FROM OSTEOMYELITIS OF THE FRONTAL BONE, ORIGINATING IN THE LEFT FRONTAL SINUS

Aside from these instances where infection reaches the brain through wounds brought about by injuries resulting in compound fracture, the majority of abscesses of the brain originate in osteomyelitis of the bones of the skull. The type most commonly observed is that which originates in the tympanic cavity or in some of the accessory sinuses of the nasal passages. Infection extends to the bony wall of the cavity producing an ostomyelitis, and may cause extradural abscess; then, if not drained, an abscess of the brain.

The case here presented followed a massive osteomyelitis of the frontal bone, manifested mainly over the right side of the forehead, though, apparently, having its origin in the left frontal sinus.

The cause of the infection was somewhat in doubt, being ascribed by those who saw him at his first operation, to an infected hematoma resulting from a football injury. This was questionable, and from observation of conditions which I found at operation on October 18th, I am definitely of the opinion that an infection of the frontal sinus extended to the wall of the sinus, and from that starting point involved a large part of the frontal bone, manifesting itself principally on the right side of the median line.

The patient, John A., white male, aged eleven, had been previously admitted to the hospital on September 18th with swelling over the right side of the forehead and an abscess pointing below the left supra-orbital ridge.

x-Rays of the skull were made, but showed no evidence of osteomyelitis. It may be noted here that in the early stages, osteomyelitis may not be demonstrable by means of the *x*-ray, but later on *x*-ray evidence is unmistakable.

The abscess was opened through an incision below the left supra-orbital ridge and the patient went home in a few days, remaining well several days, when he had two convulsions. Upon recovering from these, he remained well until October 15th, when he began to suffer from headache and the swelling returned to the right side of the forehead. He was readmitted to St. Vincent's Hospital on October 17th and I was requested to see him the following morning. *x*-Ray showed a large area of necrosis of the frontal bone as indicated in Fig. 337. The area involved extended from the region of the left supra-orbital ridge across the middle line and well up on that part of the bone which represents the right side of the forehead. A small fistula in the line of the scar from his first operation lead down to an area of necrosis on the left supra-orbital ridge. A diagnosis of osteomyelitis

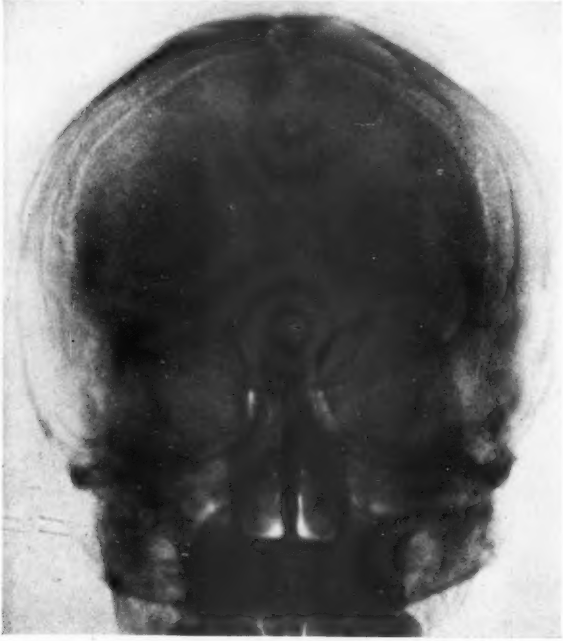


Fig. 337.—*x*-Ray plate showing area of osteomyelitis of frontal bone in case of cerebral abscess.

of the frontal bone was made, and operation was undertaken for removal of sequestra and to provide for drainage.

Operation.—Ether.

1. The old scar was reopened and the incision was extended to the root of the nose, then upward over the forehead for full exposure of the necrotic area.

2. The roof of the left frontal sinus was entirely removed and the cavity was cleared of infectious material. The outer table of the frontal bone seemed chiefly involved in the necrotic process and all this was cleared away. In a few small areas the entire thickness of bone was involved, and these areas were removed, leaving the dura exposed.

3. Adequate drainage was provided to the extradural space and to other deep recesses of the wound.

4. Partial closure of the wound was effected in an attempt to minimize the amount of scarring.

Convalescence was prompt and without elevation of temperature and the wound had healed completely except for small granulating areas at site of the drains when he left the hospital on November 1st, the fourteenth postoperative day. He was dressed three times at the office and the wound healed completely.

On November 7th, one week after leaving the hospital, he had a severe headache with nausea and vomiting. This recurred the following day and he was again admitted to hospital on November 9th.

It was evident that he was developing some serious intracranial complication, but localizing symptoms were lacking. Dr. Edgar Collins was called in for examination of eyes and reported no choked disk, fundus of each eye normal, pupils equal and react normally.

Dr. B. D. Sibley examined ears, nose and throat, and reported negative findings.

He remained under the observation of Dr. John Douglas, his family physician, Dr. H. S. Ward, neurological consultant, and myself until November 14th, when the diagnosis of brain abscess was made.

On November 11th the following notes were recorded: Temperature has been normal or slightly subnormal since admission; the pulse rate has been slow, 58 to 70; the patient complains of pain over the right temporal region; there is a healed scar from recent operation running vertically in center of forehead and extending across the left supra-orbital ridge; there is no tenderness or swelling over the operative field; cranial nerves function normally; abdominal reflexes not obtained; plantar reflexes indefinite; double Kernig sign present, but no rigidity of neck; no pain on moving head in any direction; hearing unimpaired.

Laboratory Findings: Urine, 1.020; acid, faint trace of albumin, no sugar, no casts, a few leukocytes. Blood examination: Total white count 11,650; lymphocytes 15 per cent; neutrophils 85 per cent. Lumbar puncture: 40 mm. pressure; 10 cc. removed; cell count 71 per cmm.; Wassermann negative; smear, no organisms; culture, no growth after seventy-two hours; globulin plus 4; colloidal gold curve, 1.1.1.1.0.0.0.0.0; differential cell count, lymphocytes 46 per cent, neutrophils 54 per cent.

November 12: Lumbar puncture had somewhat relieved the headache, but patient was more restless; there was frequent spasm of muscles supplied by the right seventh nerve; there were periods of double vision; there was an intermittent squint of the left eye; the hearing in right ear seemed diminished; abdominal reflex was present on right side but could not be obtained on left. Other reflexes were unaltered.

November 13th the condition of the patient remained unchanged. Lumbar puncture showed less pressure than on the 11th, but the cell count had risen to 206.

November 14th. Observation of the patient for the past four days had shown a gradually increasing discomfort, a more persistent restlessness, and a perceptible loss of strength. On this date, there was a slight rise of temperature and an increase in leukocytosis.

In the absence of any evidence of meningitis, and reviewing my former experience in cases somewhat similar, we made a tentative diagnosis of abscess of the right frontal lobe of the brain, and exploration was carried out.

Operation.—Ether 2.50 to 3.35 P. M.

1. The vertical scar was reopened and the incision was extended across the right side of the forehead over the supraorbital ridge. The flaps were retracted exposing the entire area of diseased bone. The dura covering the anterior part of the right frontal lobe was exposed by removing all overlying bone.

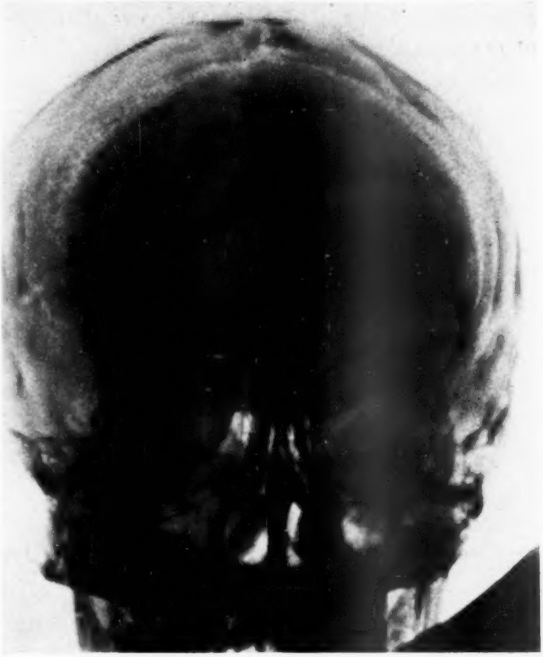


Fig. 338.—*x*-Ray plate showing extent of loss of bone in case of cerebral abscess.

2. Examination of dura and brain.

A spot not more than $\frac{1}{16}$ inch in diameter on the surface of the dura presented the appearance of a minute extradural abscess. Elsewhere the dura was smooth, but very tense. The dura was opened by means of a crucial incision and the flaps were widely retracted. The brain buldged into the opening; was smooth and normal in appearance, and no cerebrospinal fluid escaped.

3. Location and drainage of abscess.

Exploration with a hollow needle located an abscess approximately 1 inch beneath the surface of the brain, from which escaped about 5 cc. of pus. On culture this was shown to be due to Staphylococcus aureus.

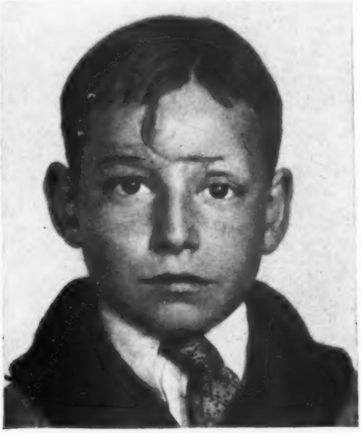


Fig. 339.—Shows appearance of the scar after the fungus cerebri has receded and the patient has completely recovered.

The opening in the brain was enlarged and one cigaret drain with small rubber tube in the center was placed in the cavity and the wound was partly closed.

4. Postoperative Course: There was but little drainage from the abscess, but the wound in the soft parts suppurated slightly. Relief from headache, nausea, etc. was prompt and definite. The wound was dressed twice daily. On the afternoon of the fourth postoperative day the patient had some headache and became very restless. At 4 P. M. he had a slight convulsion. I was called and immediately examined the wound, removed the

drain and passed a small hemostat into the drain tract. This was followed by a gush of fluid and pus, perhaps an ounce in quantity. A drain of folded rubber tissue was placed in the cavity.

He was entirely relieved from discomfort and from this time on his convalescence was uninterrupted.

A rather frightful looking fungus cerebri developed, but this was covered with skin grafts on December 19th, and healing took place promptly with complete recession of the herniation. The patient has remained under observation and is entirely well at this time, March 25, 1930. Figure 338 shows the extent of loss of bone. Figure 339 shows the present condition of the operative scar.

CLINIC OF DR. IRVIN ABELL

St. Joseph's Infirmary, Louisville, Ky.

CARDIOSPASM

Case I.—White male, aged fifteen. Personal history is negative for illness other than the diseases of childhood, none of which occurred in recent years.

Present Complaint.—Difficulty in swallowing, duration one year. Patient states that food passes throat but then stops.

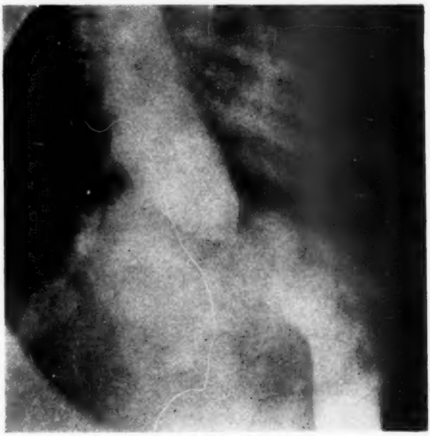


Fig. 340.—Case I. Cardiospasm.

At times he has been able to force it on into stomach, at times he is able to eat solid food which stops a minute, then goes on down. Experiences greatest difficulty in swallowing fluids, least difficulty in eating ice cream. Water runs up his throat at night soiling pillow. Maximum weight 80 pounds; present weight 68 pounds. Physical examination negative other than for cardiorespiratory apical bruit with sinus arhythmia. Blood shows secondary anemia. Urine shows two plus albumin, trace of sugar, and occasional hyaline cast. *x*-Ray: Cardiospasm with three fingerbreadth dilatation of lower third of esophagus.

Treatment.—Tincture belladonna: Dilatation.

Case II.—White male, aged fifty-three. Personal history negative for illness since childhood other than present complaint. Difficulty in swallowing first noted thirty years ago. During a period of years the difficulty appeared intermittently, alternating with periods during which he experienced no difficulty. In the words of the patient, "the food after swallowing did not go into the stomach" if he was unable to force it into stomach by drinking water freely, he spat it up. In recent years the difficulty in swallowing has been noted rather constantly, there being periods of days when but little solids or fluids were retained. Gas and fulness, with sour stomach and constipation, have been noted in last few years. Average weight 145 pounds, present weight 134 pounds. Physical examination, blood and urine, negative other

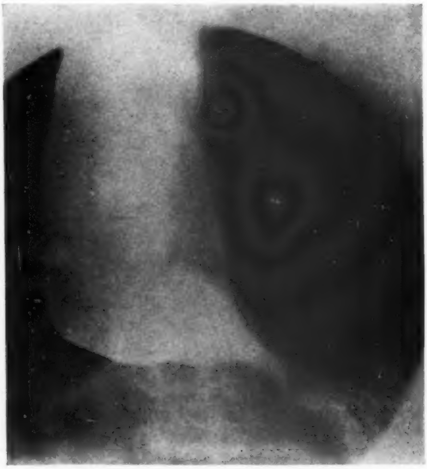


Fig. 341.—Case II. Cardiospasm.

than for tenderness in epigastrium. *x*-Ray: Esophagus greatly dilated due to fusiform narrowing at esophagocardiac juncture. Esophagus dilated as high as arch of aorta and lies mainly to right of spine, more so than is usually seen in cardiospasm. Insufficient barium enters the stomach to afford adequate visualization of the latter.

Diagnosis: Cardiospasm.

Treatment.—Tincture belladonna, dilatation.

CARDIOSPASM WITH ESOPHAGEAL SACCULATION AND DIVERTICULUM

Case III.—White male, aged thirty-eight. Personal history negative for illness other than present complaint which he defines as "stomach trouble." In 1917 he noted digestive disturbance of an indefinite character. *x*-Ray examination at that time "was negative for any cardiac enlargement or shadows suggestive of tumors in the mediastinum. There was no stoppage of barium in the esophagus, no suggestion of stricture, spasm, or diverticulum." In the last six months he has been unable to eat, stating that the food stopped behind the sternum. In the last six weeks he has retained no solids and but little fluids. No pain other than discomfort after efforts at swallowing. Has noted a 35-pound loss in weight. Present weight 133. Blood and urine negative. Physical examination negative other than for small adenoma in right lobe of thyroid.

x-Ray: Fluoroscopic examination shows sacculation in right chest with fluid level at lower border of clavicle. Upon swallowing a thick barium mixture the meal passes down to a point above the diaphragm, then enters the shadow to the right; as this fills the meal passes over to the left with slow, intermittent passage of small amounts into stomach, the latter being of normal contour, but of decreased capacity from nonuse. The whole medial half of right chest from diaphragm to first rib fills with barium, filling from bottom, the presence of air being demonstrated between the sac and the upper portion of esophagus. A small pharyngo-esophageal diverticulum is present, the fundus of which is at the suprasternal notch.

Diagnosis.—Cardiospasm with esophageal dilatation and sacculation. Pharyngo-esophageal diverticulum.

Esophagoscopy: Sac emptied of 3 pints of fluid containing barium. Retention of particles of latter prevented satisfactory visualization. Sac irrigated on three consecutive days with saline during which time atropine was administered. A second examination with the esophagoscope showed the opening of the diverticulum at the usually observed location on the posterior wall at the pharyngo-esophageal junction. The instrument readily passed into the dilated esophagus below, the mucosal covering being smooth presenting a catarrhal esophagitis without evidence of fissure or ulceration; the cardia was visualized and a bougie passed into the stomach.

Treatment.—Tincture belladonna: Dilatation with bougie, later dilatation under hydrostatic pressure.

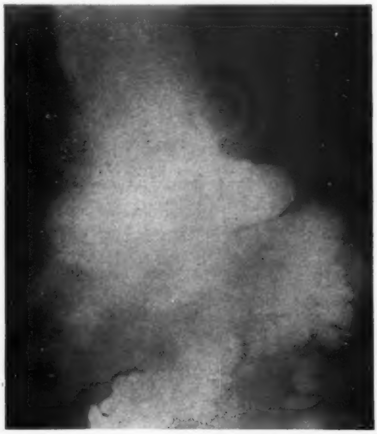


Fig. 342.—Case III. Cardiospasm, with esophageal sacculation and diverticulum.

Comment.—The etiology of cardiospasm is obscure. The musculature is hypertrophied and the mucosa shows a chronic catarrh as the result of irritation from decomposition of retained food particles. Spastic contraction of the circular fibers in the region of the diaphragm has caused the appellation of cardiospasm to the condition although the spasm occurs at the hiatus and not at the cardia. Failure of the normal closure of the lower end of the esophagus to undergo relaxation during the act of swallowing, not an actual spasm but a permanent prolongation of the normal sphincter-like condition, has been suggested as a possible cause. Division of the vagi fails to produce dilatation of the esophagus and the lower end of the tube remains closed. The majority of observers believe that there is an underlying neurosis even though its modus operandi is at present not clear. The diagnosis is always strongly suggested by the history and readily confirmed by the *x*-ray. The 3 cases herewith reported represent different periods of life and differing degrees of dilatation from a moderate distension of the lower portion of the esophagus to a rather huge sacculation holding more than 3 pints of fluid. In reading the history of cardiospasm one is impressed with the ingenious plastic operations that have been devised and put into execution for its correction. Reisinger, von Mikulicz, Schlaffer, Gottstein, Roepke, Braine, Heller, Wendel, Schintzler, Lambert, Zaaizer, and others, have contributed operations or modifications which in the light of our present knowledge are no longer employed. The inevitable risks which they entailed and the results obtained are prohibitive when compared with the relief afforded by dilatation. Measures looking toward a reduction of

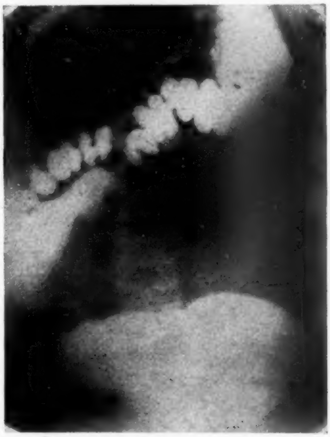


Fig. 343.—Case III. Cardiospasm with esophageal sacculation and diverticulum.

the catarrhal esophagitis, belladonna as an aid in securing relaxation, with systematic dilatation, at first with bougies, later with hydrostatic or air dilator, may be employed with but slight risk and afford relief or cure in the vast majority of cases. In those cases in which the passage of dilators per oram is impossible, or in which the difficulty encountered in so doing, is such as to endanger the patient from injury at the site of contracture, a preliminary gastrotomy with retrograde dilatation is available and preferable to other operative procedure.

DIVERTICULUM OF ESOPHAGUS

Case IV.—White male, aged forty-five. Personal history negative for illness since maturity other than for pneumonia at thirty-three. Present complaint, difficulty in swallowing, duration three years. First symptoms noted was an irritation and fulness in throat with the expectoration of tenacious mucus together with food particles. In the past two years swallowing has become progressively more difficult: in the last three months he has been unable to swallow solid food. Upon drinking a full glass of water or milk it is soon regurgitated. Complains of throat being dry and of expectorating mucus which at times is blood tinged. He states that he is conscious of a stoppage in his throat which is accompanied by a sense of fulness when he attempts to swallow solids or liquids, followed by immediate or slightly delayed regurgitation. Usual weight 180 pounds, present weight 113 pounds. Patient presented the evidences of starvation and dehydration. Vital organs negative for evidence of organic disease, blood pressure 84/64, pulse 90; blood showed a secondary anemia. Tongue furrowed, thick, and coated. Mucosa of palate and pharynx markedly injected.

x-Ray: Large esophageal diverticulum with a capacity of 1 pint which takes a course well down into right side of the thorax. None of the barium passed into the stomach.

Diagnosis.—Diverticulum of esophagus, starvation, dehydration. Efforts were made to pass bougies in the hope of being able to introduce a tube into the stomach for purposes of nutrition, but all such met with failure, the bougie invariably entering the diverticulum. Thread, swallowed, likewise failed to pass and this procedure was abandoned after a three-day trial. Three unsuccessful efforts were made by the bronchoscopist to locate and enter the esophagus under direct vision. Deeming it imperative to increase the patient's resistance before attempting the removal of the diverticulum a gastrostomy, Witzel method, was done, through which food and drink were given. Thirty-six days later, when he had gained considerably in weight and strength, the first stage of the removal of the diverticulum was undertaken. A 5-inch incision was made along the anterior border of the right sternomastoid muscle: The muscle and underlying carotid vessels were retracted outward, the trachea, larynx, and thyroid retracted inward after first ligating the superior and inferior thyroid arteries. The diverticulum was separated from its bed in the chest, freed by dissection up to its neck, completely emptied of its contents and twisted on itself so as to obliterate its cavity, wrapped in rubber tissue and placed in the upper angle of the incision. The entrance to chest cavity was loosely packed with gauze and the wound partly closed. Twelve days later the wound was reopened, the diverticulum amputated, its neck scarified of mucosa and closed with catgut. Small drain of rubber tissue was placed down to site of amputation and wound closed. Feeding through the gastrostomy tube was continued for ten days when it was removed and oral feeding resumed. Convalescence was uneventful. The patient rapidly regained his weight and strength and resumed his occupation as traveling salesman.

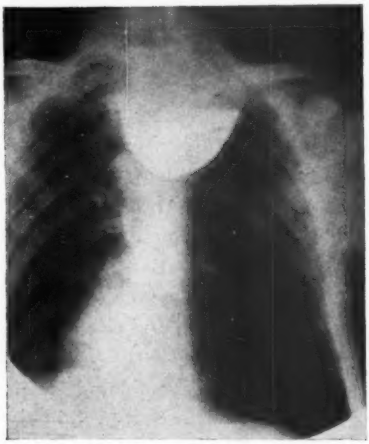


Fig. 344.—Case IV. Diverticulum of the esophagus. Front view.

Comment.—The point of origin of the diverticulum in this case comformed to that most frequently observed in pulsion diverticula, namely, the posterior wall of the esophagus at about the level of the cricoid cartilage. At this site the musculature is not as strong as elsewhere and when the muscles contract in the effort to force down a bolus of food, the uppermost longitudinal fibers and the transverse fibers immediately above them pull on this weak spot from different angles. It is probable that the trauma occasioned by hastily swallowing imperfectly masticated food materially helps in the separation of muscle fibers at this point, the mucosa protruding through the gap to form the diverticulum. Always small at the time of its origin, the sac may increase in size, until as in the present instance, it dips well down into the thorax. The sac usually follows a course down the left side of the neck, rarely down the right side. When the sac remains in the neck it may in some instances be visible and palpable. The decomposition of retained food imparts a foul odor to the breath. Pressure symptoms are occasionally noted; hoarseness from pressure on the recurrent laryngeal nerve;

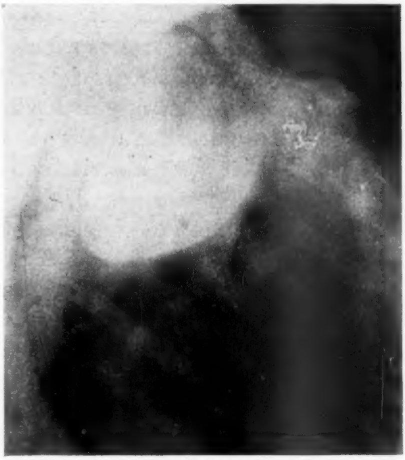


Fig. 345.—Case IV. Diverticulum of the esophagus. Lateral view.

ptosis of the lid or exophthalmos from pressure on the sympathetic; dyspnea from pressure on the trachea by a large intrathoracic sac. While the symptoms at times are sufficiently clear to warrant a diagnosis, the latter is arrived at definitely by roentgenological study. When the sac is small and the patient's general condition has not been greatly lowered by starvation and dehydration it may be removed without delay by a one-stage operation. When there has been lowering of vitality by reason of lack of food and drink appropriate measures should be undertaken to remedy this deficiency. This may be accomplished in one of three ways: First, preferably by feeding through a catheter introduced into the esophagus or a Levin tube passed into the stomach. Second, when the emaciation and weakness are not too great, glucose intravenously and saline subcutaneously, will afford sufficient recovery to render the operative risk not unreasonably large. Third, when devitalization and weakness are extreme, as in the case reported, prolonged feeding through a gastrostomy furnishes the sustenance upon which a recovery of vitality depends. The location of the sac determines the route of approach, whether through right or left sternomastoid incision. Difficulty in identification of the sac may be overcome by the introduction of a bougie or the esophagoscope through the mouth, tilting it so as to bring the sac out into the wound. When the sac is small, the operation may be completed at one sitting, when of appreciable size and particularly when it invades the thorax, the danger of leakage with resultant cellulitis and mediastinitis is such as to give the two-stage operation the preference.

FALSE HERNIA OF THE DIAPHRAGM WITH DILATATION OF THE CARDIA AND ESOPHAGUS

Case V.—White female, aged sixty-two, first came under observation in April, 1921. She passed the menopause at the age of forty-eight and is the mother of nine children. She gave no history of acute illness, her chief complaint being "stomach trouble" which she stated had existed for about ten years. Fulness and sour stomach were occasionally noted after eating, the discomfort being a quantitative one rather than a qualitative one. She stated that as long as she was up and about her discomfort was practically negligible; no nausea, no constipation, at times a mild diarrhea was present. A striking feature of her history was the fact that her discomfort manifested itself almost solely when in the recumbent position. She stated that when lying down her "food came up into her throat." Rarely did she escape being awakened at about midnight with a sense of fulness and choking accompanied by a burning sensation at pit of stomach and back of sternum, relief from which was usually obtained by induced vomiting. No history of blood in vomitus or stool. She had sustained a slight loss in weight, but was well preserved and vigorous for her age. Weight 145; heart and lungs negative; blood pressure 140/74; reflexes active; teeth good; blood and urine negative; slight rigidity and tenderness below ensiform and to a less degree along the right costal margin. Feces showed the presence of encysted ameba. *x*-Ray examination revealed marked pylorospasm. Following administration of belladonna fluoroscopic examination with patient in the erect position showed a normal stomach; by exerting pressure on the abdomen barium could be forced up into the esophagus. Fluoroscopic examination in the horizontal position showed the stomach contents gravitating to the cardiac end of the stomach and regurgitating into the esophagus, which was dilated to about two and one-half times the normal size. Many deep peristaltic waves were noted passing through the esophagus. Plates showed deformity at cardia and probable regurgitation through opening into esophagus with dilatation of lower part of the latter.

Diagnosis.—Wide open orifice between stomach and esophagus with marked dilatation of lower third of esophagus. Because of the observation of peristaltic waves at the opening, the latter was not thought to present organic change.

At operation in May, 1921 examination of the esophageal opening in the diaphragm showed the presence of a false hernia; while no sac could be demonstrated the opening was large enough to admit easily four fingers. The peritoneum overlying the crura of the diaphragm was incised, the crura exposed and approximated with mattress sutures of Pagenstecher linen until the opening would admit but the tip of the index finger. The stomach, pylorus, and duodenum were negative for ulcer or other visible defect. The gallbladder showed the presence of a chronic noncalculous cholecystitis and was removed. Common duct and pancreas were negative. The appendix was large, negative in appearance, and was removed. The report of the microscopical examination was chronic cholecystitis, healed appendicitis. Recovery from operation was uneventful and relief from symptoms complete for a period of five years. She was seen again in December, 1926 at which time she stated that during the preceding six months she had noted a recurrence of symptoms; in addition to those observed previous to operation she experienced rather severe paroxysms of coughing when awakened at night by epigastric discomfort. She had found that sleeping in the semi-reclining posture materially lessened both the frequency and severity of the epigastric discomfort, and the paroxysms of coughing. Roentgenological examination showed a five-and-a half-hour residue of 50 per cent of the motor meal. There was active gastric peristalsis with a large amount of the meal regurgitating into the esophagus, the latter showing a three-fingerbreadth-sized dilatation from the fourth dorsal vertebra downward. Active esophageal peristalsis was noted. No evidence of ulcer or neoplasm in stomach or duodenum. Soft, bland foods with tincture belladonna afforded much relief. She was seen no more until this year, now nine years after operation and now seventy-one years of age, when she states that in the past two years the paroxysms of coughing and vomiting have been distressing, occurring practically only when in the recumbent position. This has prevented adequate rest and has been accompanied by a loss of 32 pounds in weight. Examination shows the lungs clear, the myocardium weak and renal efficiency greatly impaired. Gastro-intestinal examination with patient in the erect position showed normal passage of barium through the esophagus into the stomach with normal filling of the latter and duodenum, there being no evidence of organic filling defects in either. Upon putting the patient in the recumbent position about one half of the stomach contents regurgitated into the esophagus, which showed uniform dilatation. The small intestine and colon were negative. Death occurred seven weeks after admission to hospital.

Fig. 346.—Case V. Take hernia of the diaphragm with dilatation of the cardia and esophagus.

Comment.—It is difficult to satisfactorily explain the persistent gastric and pyloric spasm with reverse peristalsis exhibited by this patient. The cause of such spasm is not definitely known, it may be a nervous manifestation, it may be caused by disease of the stomach or be a reflex action from disease of other organs, notably the gallbladder and appendix. Reverse peristalsis is likewise noted in the presence of irritations in the gastrointestinal tract. Dilatation of the esophagus is ordinarily found in the presence of obstruction. Repeated fluoroscopic examination in this patient revealed no hindrance to the passage of barium into the stomach. The unusually large opening at the site of the esophageal aperture in the diaphragm, constituting a false hernia, deprived the cardia of its normal tone and support, permitting the reverse peristalsis to dilate the cardia and lower esophagus by retrograde pressure. True diaphragmatic hernia involving the esophageal aperture is usually congenital; since the symptoms in this patient became manifest at the age of fifty-two, it may be assumed that the defect in the diaphragm was an acquired one, resulting from muscular atony and relaxation rather than from trauma. The correction of this with the removal of the diseased gallbladder and appendix eliminated all discernible causes for spasm and reverse peristalsis and apparently accomplished the desired aim for a period of five years. The patient was engaged in business of rather large proportions and previous to the recurrence of symptoms had undergone much worry on account of reverses. It is possible that this may have been a factor in inciting more active spasm. Preceding the marked aggravation of symptoms before her final illness she suffered the loss of two of her children and again the resulting nervous upset may have contributed to the causation of more active spasm. The chief rôle, however, in the light of the history, operative and *x*-ray findings, must be attributed to the false hernia and its recurrence five years after repair.

CLINIC OF DR. R. L. PAYNE

St. Vincent's Hospital, Norfolk, Va.

EPIDERMOID CARCINOMA

It is apparent that the surgical problem of superficial skin malignancies has never in the past received very intelligent attention by well-trained surgeons and it is also quite evident that even in this day and time the average busy surgeon, who is doing a large amount of general major work, is disposed to delegate the handling of these lesions to *x*-ray laboratories for treatment. Every finished surgeon should be intensely interested in the pathology of diseased conditions and in all of our professional work there is never as good an opportunity to study and learn living pathology, such as falls to the lot of the surgeon. A surgeon keen with his ability of observation usually acquires a knowledge of new growths which should mean more to the suffering patient than could possibly be given to cases by physicians in other specialties who first are not interested, as a rule, in pathology and who are seeing only an occasional case in contradistinction to the surgeon to whom a majority of these cases eventually find their way.

This clinical presentation of epidermoid carcinoma is the result of a general surgeon's observation and treatment and the work was undertaken with the hope that through an experienced knowledge of living pathology coupled with some maturity of surgical judgment the end-results attained in skin cancer might be improved over the rather poor results that have been generally prevalent in this particular community.

The author has no pointed criticism to make of any *x*-ray laboratories who are treating these cases with *x*-ray and radium, yet it is a very common experience to have cases referred to me which have been treated with *x*-ray and radium in the hands of men who are not specializing in surgery yet have equipped themselves through the advertising of producers and manufacturers. These various commercial agencies send out an immense amount of descriptive literature, making it appear that practically any form of superficial malignancy can be handled by the average practicing physician, providing he has some equipment of either *x*-ray or radium; and treatments, many times, are directed through the selling agents by letter correspondence. It is a rather singular fact that practically every case which we have treated with poor results or complete failures had been previously treated by *x*-ray or radium in the hands of one who was not specially trained and who could not have much knowledge relative to the interpretation and diagnosis of the living pathology in the individual case.

Generally speaking an experienced surgeon can differentiate between basal and squamous-cell epithelioma by the naked eye or with the magnifying glass together with a consideration of the location of the lesion. Occasionally nothing short of biopsy findings will prove a given diagnosis. There is always a very distinct difference in the handling of these separate types of skin cancer, for the pure basal-cell type never metastasizes whereas the squamous-cell carcinoma readily metastasizes. Again the specific location of a particular lesion is most important with reference to metastases and it is rare that medical men other than surgeons are familiar with the lymphatic connections and this is a most important factor in the permanent cure of any skin cancer. Emphasis upon this point cannot be too strongly made when we bear in mind the fact, which is not described in any of the text-books, namely, that basal-cell epithelioma frequently eventuates into the squamous-cell type and local cure may often be readily obtained, yet metastases to the neighboring lymphatics subsequently follow to the destruction of the patient and the chagrin of the one administering treatment.

At the present time we do not know the cause of cancer, but in order to formulate a definite aggressive mode of treatment it is necessary that we entertain and accept some definition of the malignant hyperplasia upon which our methods of attention may be predicated. It seems to the writer that the simplest conception is, that cancer is nothing more or less than normal structures gone astray and growing beyond their normal bounds. This, of course, is an old idea yet in the treatment of superficial malignancy in our hands the acceptance of this definition of cancer has fulfilled a definite place in formulating our conception of treatment. Given a local epithelioma, as an example on the cheek, we would interpret this theory as meaning that not only have the normal cells in the malignant lesion become hyperplastic, but also that the normal cells in the skin surrounding the lesion for a certain distance partake of the same tendency to overgrow outside their normal bounds and therefore these cells surrounding the neoplasm, though apparently normal, have potentially malignant possibilities and therefore must participate in some part of the treatment that is accorded to the primary neoplasm. Briefly stated we feel that not only must we bring about a healing of the primary neoplasm, but there must be produced retrogressive changes in the normal epithelial cells surrounding the neoplasm for a reasonable distance in order to forestall what we accept as an inherent tendency of all the cells in the immediate neighborhood to go astray and grow viciously beyond the normal bounds.

To bring about these retrogressive changes above described in the surrounding, yet apparently normal cells, we have two reliable agents, namely, radium and *x*-rays, whic can be depended upon for the purpose desired. Theoretically and practically, as far as I am able to determine, radium or *x*-ray accomplish identically the same result in the important retrogressive changes in normal or inherently abnormal cells such as would be desired from the above-outlined concept. The problem, therefore, of treating a malignant lesion of the skin is dependent upon, first, a complete destruction of the primary lesion followed by *x*-ray or radium treatment to the surrounding normal cells whereby the character must be changed and the possibility of further hyperplasia or recurrence prevented.

Let us now consider the question of destruction of the immediate primary neoplasm. This may consist of a fractional and progressive destruction by radium or *x*-rays on the one hand,

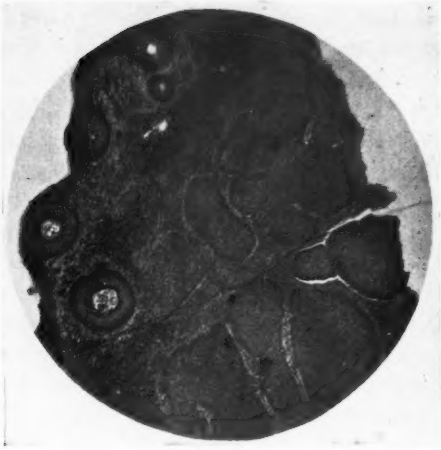


Fig. 347.—Basal-cell epithelioma showing discreet islands of cells which show no direct connection with the epidermis.

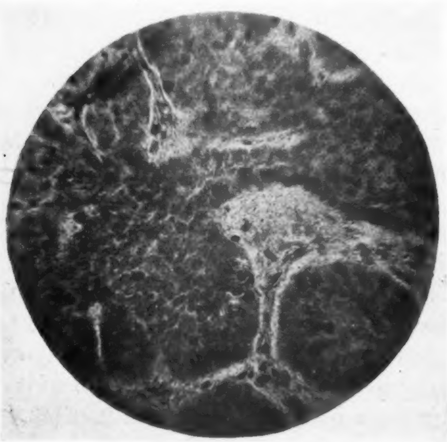


Fig. 348.—High power of basal-cell epithelioma showing islands of epithelial cells which have large darkly staining nuclei and very little or any cytoplasm.

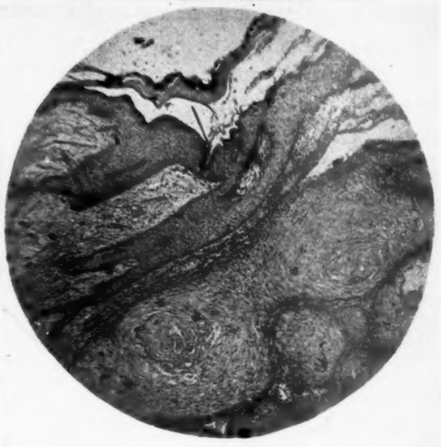


Fig. 349.—Low power of squamous-cell epithelioma showing long columns of squamous epithelium dipping down into the tissues having a continuous connection with the superficial stratified epithelium. Nests of squamous epithelium or so-called "pearls" showing degeneration and keratinization in the center of cell groups.

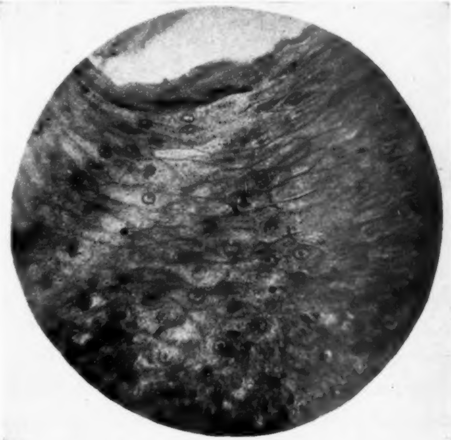


Fig. 350.—High power of basal-cell epithelioma showing typical stratified squamous epithelium having small nuclei and a large amount of cytoplasm.

an immediate and complete destruction of the growth by endothermic methods or scalpel excision. Because of the location and involvement of important structures it is rarely possible to do a scalpel excision of the growth followed by primary suture and therefore in the majority of epitheliomas endothermic destruction is the method of choice. Our results, however, will indicate that providing radium or *x*-rays are properly administered following the eradication of the growth there is practically no difference in the number cured whether excision or immediate endothermic destruction is carried out. It is, however, more than likely that the extension of heat into the normal tissue surrounding a neoplasm incident to endothermic destruction brings about certain desirable effects which would not obtain in scalpel excision of the growth. It is also true that our series of cases treated by radium alone or by endothermy and radium form such

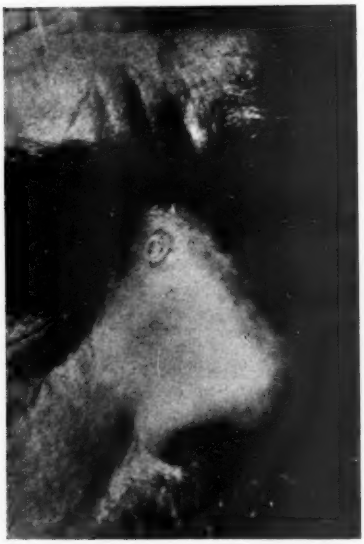


Fig. 351.—Typical basal-cell epithelioma on bridge of nose.

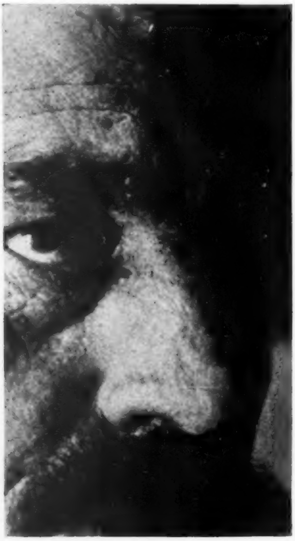


Fig. 352.—Showing cure of growth shown in Fig. 351.

a preponderance over the cases treated by excision and radium that conclusions of definite character are not warranted.

One of the most important things to be remembered in the local destruction of a neoplasm in the skin or mucous membrane is that the sweat glands dip down through the corium into the fat and therefore it is not only important to destroy a neoplasm widely into normal skin, but also to go deep enough into the fat so that the epithelial elements of the sebaceous glands and hair follicles are completely destroyed. Some pathologists contend that basal-cell epitheliomata arise from the hair follicles and therefore call these lesions hair-matrix carcinoma. My study, however, of many microscopic sectionsal of these so-called "basal-cell" types give me the impression that they originate from hyper-

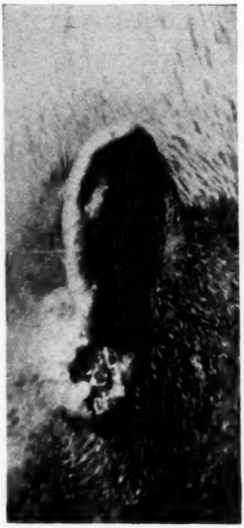


Fig. 353.—Typical basal-cell epithelioma at angle of jaw with deep ulceration and overhanging edges. Wide and deep destruction in this type is very essential to cure.

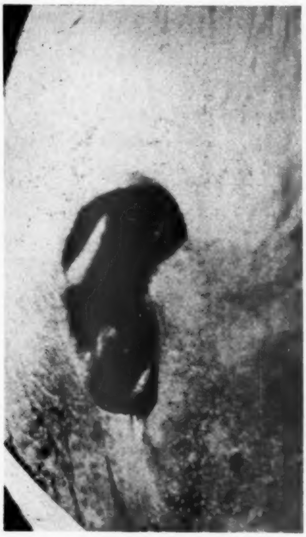


Fig. 354.—Showing cure of growth shown in Fig. 353.

plasia of the true basal cells in the malpighian layer of the skin and I think this is the generally accepted hypothesis.

The study herein presented by the series of charts permits conclusion to be drawn from a series of 405 cases which have been accurately traced and the end-result definitely determined. This series of cases has been divided into two groups. The first group of 201 cases was treated exclusively by radium, with a mortality of 7 per cent. You will therefore understand that in this group cure was sought by a graduated fractional destruction of the lesion which extended over a period ranging from ten days to many weeks. In the second group of 204 cases the treatment consisted of complete and immediate destruction by endothermic methods with a result of 2.9 per cent mortality.

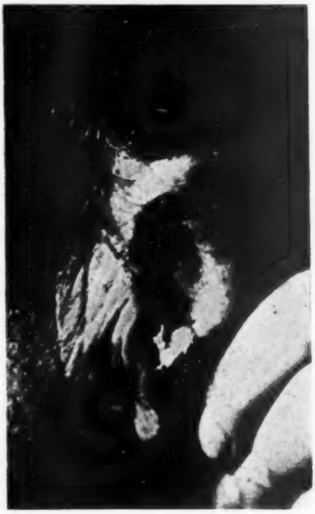


Fig. 355.—Basal-cell epithelioma of ear with ulceration involving underlying cartilage. This type is difficult to obtain healing because of poor circulation in the cartilage which always partakes of the ulcerating destruction.

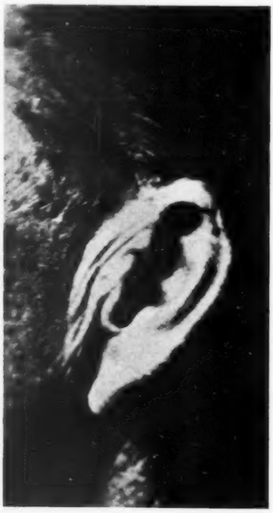


Fig. 356.—Showing cure of growth in Fig. 355.

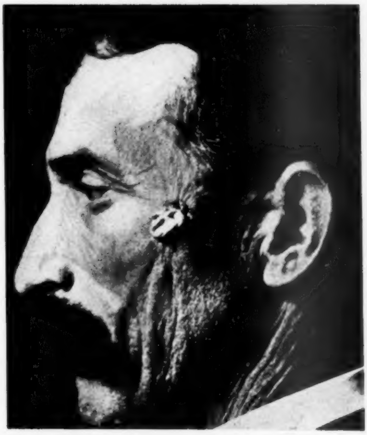


Fig. 357.—Showing mixed type of basal-cell and squamous-cell epithelioma with large area of cornification resulting from degeneration and keratinization of the epithelial cells.

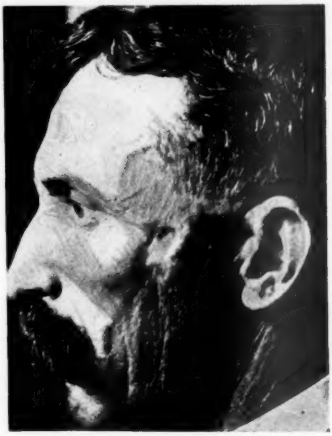


Fig. 358.—Showing cure of growth shown in Fig. 357.

The difference in mortality rate between these two groups treated on the one hand by gradual destruction with radium and immediate destruction by endothermic methods is distinctly

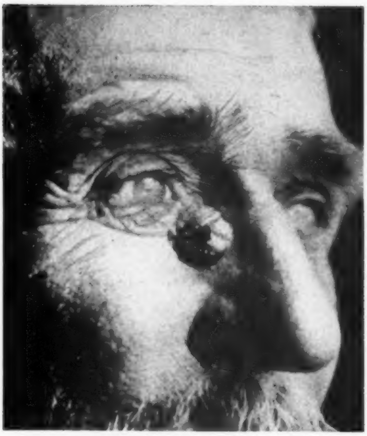


Fig. 359.—Rather large basal-cell epithelioma with marked hyperplasia around the periphery and ulceration in the center. This type almost invariably spreads toward the inner canthus.

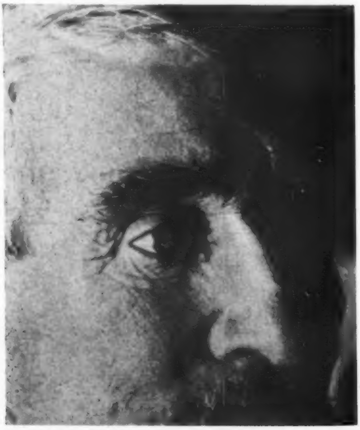


Fig. 360.—Showing cure of growth shown in Fig. 359.

apparent. In a group, segregated from the whole, that had immediate endothermic destruction there are 75 cases which were treated by immediate endothermic destruction and followed by radium to the surrounding normal tissue. In this group all the cases were cured and it would seem that by comparison with radium or endothermy alone the combined method of endothermy followed by radium will give the most efficient end-result.

It would be quite natural for one to enquire why such a large number of cases in the second group were treated by endothermy alone instead of following each endothermic destruction with radium to the surrounding skin. The answer is that all these cases treated by endothermy alone were thought to be simple basal-cell epithelioma and the value of the combined treatment to all cases was not quite so apparent to us until we had completed, just recently, a final survey and comparison of the total of 405 traced cases. There is no doubt that these cases which we considered to be simple basal-cell in type were, in some instances, either primarily squamous-cell or a primary basal-cell type which

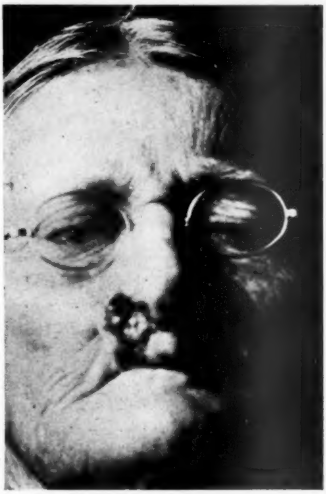


Fig. 361.—Mixed type of basal and squamous-cell epithelioma involving both mucous membrane and skin of lip and antrum of nose with complete destruction of lip. One lateral incisor tooth is shown completely exposed. The central hyperplasia projecting from the nostril is pure squamous-cell type. Through the opening, resulting from complete destruction of the upper lip, one can look straight back to the soft palate.

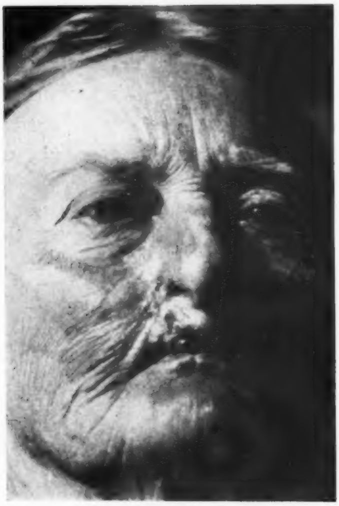


Fig 362.—Showing incomplete results of growth shown in Fig. 361 six weeks after beginning of treatment.

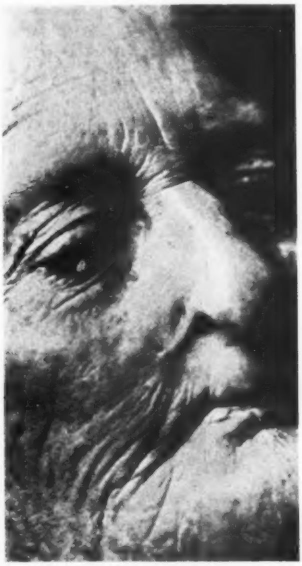


Fig. 363.—Showing complete cure of lesion shown in Fig. 361 ten weeks after first treatment.

had eventuated into a squamous-cell epithelioma. This evolution of the basal-cell type into a squamous-cell type I feel sure takes place in some cases which have been inadequately treated with radium, *x*-ray, pastes or incomplete endothermic methods and it is these recurring, inefficiently treated cases that appear to have taken on some additional stimulus in the growth which makes them notoriously resistent to the usual methods of treatment. As cited above a big majority of our failures have been in cases which have been inadequately treated before the case came under our care.

From the results as shown in the series of cases by the accompanying charts, it would seem that there is only one conclusion to draw relative to treatment. This conclusion is that all cases irrespective of the size, involvement or location should have immediate and complete destruction by endothermic methods and the surrounding structures properly treated with radium or *x*-rays in order to bring about retrogressive changes in the cells and thus prevent the inherent possibility of recurrence or renewed growth.

GROUP 1. TABLE 1. EPIDERMOID CARCINOMA

Total number of cases traced	242
Total number of cases cured	225
Total number of cases dead	17
Total mortality	7 per cent

GROUP 1. TABLE 2. EPIDERMOID CARCINOMA SHOWING RESULTS IRRESPECTIVE OF LOCATION OF LESION

Type.	No. cases.	Cured.	Dead.	Mortality.
Basal-cell carcinoma	205	191	14	6.34 per cent
Squamous-cell carcinoma	37	34	3	8.1 "

GROUP 1. TABLE 3. EPIDERMOID CARCINOMA

Type.	No cases treated.	Cured.	Dead.	Mortality.
Eyelid:				
Basal-cell	18	15	3	16.6 per cent
Squamous-cell	5	5	0	0
Total	23	20	3	15 "
Lower Lip:				
Basal-cell	18	15	3	16.6 "
Squamous-cell	5	5	0	0
Total	23	20	0	15 "

GROUP 1. TABLE 4. EPIDERMOID CARCINOMA. TREATMENT

Total cases treated by radium alone	201
Total number radium treatments	606
Average number treatments	2.98
Total cases cured by radium	184
Total number radium treatments	503
Average number treatments	2.65
Total dead treated by radium	17
Total treatments 103—Average per case	6

GROUP 1. TABLE 5. EPIDERMOID CARCINOMA

Primary growth	224	Mortality	6.2 per cent

Recurrent growths 18 or 7.4 per cent of total cases

Types recurrent growths	Basal-cell	15
	Squamous-cell	3
Recurrent growths cured		15
Recurrent growths dead		3
Mortality in recurrent growths		16 per cent

GROUP 1. TABLE 6. EPIDERMOID CARCINOMA. TREATMENT—ENDOTHERMY AND RADIUM

Total number cases		41
Types	Basal-cell	30
	Squamous-cell	11
Total number treatments		77
Average number treatments		1.87 per cent
Total number cured		41
Mortality		0

GROUP 2. TABLE 1. EPIDERMOID CARCINOMA

Total number of cases treated	163
Total number of cases cured	157
Total number of cases dead	6
Mortality	3.7 per cent

GROUP 2. TABLE 2. EPIDERMOID CARCINOMA SHOWING RESULTS IRRESPECTIVE OF LOCATION OF LESION

Type.	No. cases.	Cured.	Dead.	Mortality.
Basal-cell carcinoma	130	128	2	1.5 per cent
Squamous cell carcinoma	33	29	4	12.1 "

GROUP 2. TABLE 3. EPIDERMOID CARCINOMA

Type.	No. cases treated.	Cured.	Dead.	Mortality.
Eyelid:				
Basal-cell	12	12	0	0
Squamous-cell	6	5	1	16.6 per cent
Total	18	17	1	5.5 "
Lower Lip:				
Basal-cell	1	1	0	0
Squamous-cell	9	9	0	0
Total	10	10	0	0

GROUP 2. TABLE 4. EPIDERMOID CARCINOMA. TREATMENT

	No. cases.	Cured.	Dead.	Mortality.
Endothermy alone	120	115	5	4.16 per cent

GROUP 2. TABLE 5. EPIDERMOID CARCINOMA. TREATMENTS

Total number of cases treated by excision and radium	7
Total number of treatments	9
Average number of treatments	1.3
Total number of cases cured	7
Total number cases dead	0
Mortality	0

GROUP 2. TABLE 6. EPIDERMOID CARCINOMA. TREATMENTS—ENDOTHERMY AND RADIUM

Total number of cases	34
Total number of treatments	65
Average number of treatments	1.9
Total number cases cured	34
Total number of cases dead	0
Mortality	0

FINAL SUMMARY OF GROUPS 1 AND 2 OF ENDOTHERMY AND RADIUM. EPIDERMOID CARCINOMA.

Total cases treated by endothermy and radium	75
Basal-cell carcinoma	59
Squamous-cell carcinoma	16
Total number of treatments	142
Average number of treatments	1.81
Total number of cases cured	75
Total number of cases dead	0
Mortality	0

One chart will also indicate that epidermoid carcinoma of the eyelid and lower lip stands in a distinctly separate class from lesions located elsewhere on the body which we have studied. On the eyelid and lower lip the majority of growths are usually squamous cell in type and require a much more vigorous treatment.

With reference to the various methods of endothermic destruction of these growths, I do not think it makes any difference in the end-result whether bipolar coagulation, monopolar coagulation, or high-frequency excision is utilized providing the destruction is adequately wide and deep. My personal preference and the method we use exclusively is monopolar coagulation and desiccation. I further do not think that the type of machine used has any special significance providing the operator is thoroughly familiar with the possibilities of his equipment and is sufficiently experienced in carrying out the destruction in the proper manner. With regards to the subsequent treatments of the surrounding skin with radium, we always give a full erythema dose and cover an area, if possible, amounting to an inch or slightly more adjacent to the growth.

In conclusion I wish to summarize the study of selected groups by stating the mortality in 201 cases treated by radium alone was 8.4 per cent. The mortality in 120 cases treated by endothermy alone was 4.16 per cent. In a series of 75 cases treated by the combination of endothermy and radium there was no mortality.

CLINIC OF DR. LeGRAND GUERRY

Columbia Hospital, Columbia, S. C.

RECONSTRUCTION OF THE BILE PASSAGES

On October 12, 1918, before the Surgical Section of the American Medical Association, I read a paper on "Reconstruction of the Common Duct." At this time I reported a series of 7 cases in which the bile passages had been reconstructed. There were two deaths in this series of cases. To these 7 cases I wish to add 2 additional cases included in the report below. At another time I shall embody all of these cases in a further report on this matter. In passing I simply wish to call attention to a fact that may or may not be significant. There were no deaths in the 4 cases in which the hepatic duct was anastomosed to the duodenum and at the same time these cases of hepaticoduodenostomy have been the ones in which results have been definitely better.

Case I.—A white man seventy-three years of age presented himself complaining of pain in the abdomen and jaundice. He had been operated upon and his gallbladder removed four years before. Following this operation he was well for only a very short time. His skin remained slightly yellowish, but it was not until two years ago that he began having pain in the gallbladder region. Then followed a gradually deepening jaundice. In the past three months the pain has been quite severe, there has been more or less constant nausea and occasional vomiting, and a progressive loss in weight.

The general physical examination showed a moderate jaundice, a few coarse râles at the bases of the lungs, a blood pressure of 180/80, and a large hernia through the scar of the high right rectus incision of the cholecystectomy. There were no palpable masses in the abdomen, and the other findings were normal for a man of his age.

Except for a clotting time of six and a half minutes, the laboratory blood findings were not abnormal. They showed a faint trace of albumin, an occasional hyaline or granular cast, and a very few red blood cells and pus cells.

A high right rectus incision was made under spinal anesthesia and a mass of adhesions freed from the sight of the former gall-bladder operation. The dissection of the common duct was extremely difficult, but it was finally exposed for about $1\frac{1}{2}$ cm. along its course. It was opened just below a constriction in the duct which allowed only a pin point lumen, this stricture being just at the junction of the common and hepatic ducts. The hepatic duct above this stricture was nearly 2 cm. in diameter. A transverse section was done, the distal end ligated, and the proximal end implanted in the side of the duodenum with a double layer of catgut sutures. Several small stones were removed which had pocketed in the area above the stricture. A small cigaret drain was inserted and the wound closed in layers.

An uneventful convalescence followed. The temperature never went above 100 F., and the jaundice had almost entirely disappeared by the tenth day. There was, however, a very slight yellowish tinge to the skin upon dismissal three weeks after operation though the sclerae were entirely normal in appearance.

A subsequent report on this patient's condition one month after his return home was that the jaundice had completely disappeared and that he was improving daily.

Case II.—A white woman aged sixty-nine was seen in consultation with Dr. J. Heyward Gibbes. She complained of pain in the upper abdomen and back, of "indigestion" and of "biliousness." The family history and past history were unessential. She stated that she had "always had a weak stomach." During the month prior to admission she had increasing discomfort in the upper abdomen due to gas and pain which radiated to the right back and shoulder. She had more pain in the left back however than in the right. There was considerable tenderness in the upper abdomen for a month before she consulted her physician. The patient's stools had also been light in color for some time.

On physical examination there was a pronounced jaundice, a rather bad dental situation, a marked bilateral deafness, and a slightly enlarged heart. The blood pressure was 135/85. In the abdomen there was visible fulness and on palpation there was a crescent-shaped mass in the right half which extended well down into the right iliac region. It was smooth, oval, rather firm, and mobile with, for the most part, an ill-definable edge, but in the region of the gallbladder this edge was lost. Further examination failed to disclose other physical defects.

Under ether anesthesia a high right rectus incision was made. The liver was found occupying a very low position in the abdomen, and the gallbladder was tremendously enlarged. The head of the pancreas was indurated and enlarged. The common duct was about two thirds the size of the duodenum. There were a few adhesions around the head of the pancreas and there was a long band of adhesions running from the base of the cystic duct up over the gallbladder and across it.

As the pancreas was very mobile we were able to deliver the pancreatic head almost outside of the abdomen. The enlargement in the head of the pancreas was definite and unmistakable, it was clearly evident that the obstruction to the common duct was at this point. My first thought was that we were dealing with a pancreatic stone. This was found not to be true because a small incision was made directly over the center of the mass which was carefully stretched open with blunt forceps, and the investigation pushed to such an extent that we could be certain that no stone was present. The question then being, was it malignancy of the head of the pancreas or an inflammatory process? It looked macroscopically to be inflammatory. A bit of the pancreatic tissue was taken from the inside of the mass for microscopical examination. It proved to be inflammatory and not malignant. The pathologic report of Dr. H. H. Plowden, Pathologist for Columbia Hospital, follows:

"There was received a minute piece of yellowish-red tissue which had no particular gross characteristics.

"Microscopical sections show a tissue essentially fibrous in character. This fibrous tissue is quite dense and there are very few infiltrating cells. Those present are small in size, deeply staining, and almost the entire cell is occupied by the nucleus. One side of the sections is covered by a single layer of tall columnar cells as if it may have been part of a duct wall. Scattered through the tissue are a few ductlike structures lined by the same type of tall columnar cells. In a few areas are seen clumps of pancreatic cells arranged like an alveolus. None of these are seen to have direct connection with a duct. No islands of Langerhan were present in the sections.

"*Diagnosis.*—Old chronic inflammatory tissue (scar) in pancreas."

The obstruction to the common duct at this point apparently was complete and permanent.

Operation.—We then did an anastomosis between the lateral side of the dilated common duct and the duodenum; very much after the manner in which the above case of hepaticoduodenostomy was done.

The convalescence was entirely uneventful. The temperature never went above 99.3 F. The jaundice had entirely cleared by the twelfth day. The patients symptoms seemed entirely relieved. The stools were normal in color and the wound cleanly healed.

Further report on the case, March 31, 1930: Patient apparently completely recovered.

SHOCK FOLLOWING REMOVAL OF GAUZE DRAIN AFTER CHOLECYSTECTOMY

About eighteen years ago the first case of shock following removal of gauze drains after cholecystectomy came under my observation. The case was that of a middle-aged man, approximately forty-five years of age, upon whom we had done the operation of cholecystectomy for a very densely adherent and infected gallbladder, with a large number of stones. Great difficulty was experienced in the performance of this operation, and there resulted a persistent ooze from the neighborhood of the common duct and the fissure in the liver from which the gallbladder was extirpated. To control this ooze we used a moderate amount of gauze pack, covered by protective tissue. A bit of the fluff or free end of the gauze was placed in such manner as to directly control the oozing of blood. On removal of this gauze drain, the sixth day after operation, the patient passed into a condition of typical shock to the sympathetic nervous system. The shock was definite and profound.

During the intervening eighteen years, I have had a similar experience in 3 other cases, making a total of 4 cases. One of these in a man over sixty, who was profoundly toxic, died. The other 3 recovered.

It is my purpose in this very short paper to direct your attention to the possibilities of such an accident happening, and to suggest a method of prevention.

It has been about six years now since the last accident of this sort occurred in my personal work.

One of the most surprising features of the situation has been the fact that we can find no mention of such a condition in the literature. In all of the eighteen years in my personal reading, and observation of the literature, and in conversations with various surgeons in the country, I have seen no article bearing on this subject, and have found no one, save a former assistant of mine, who had had a similar experience, and yet I am quite convinced that the accident must have occurred to others; even though it has not found its way into the literature..

The single exception alluded to above was 2 cases occurring in the practice of my former assistant, Dr. George H. Bunch of this city.

During the past year I have had a careful abstract of the literature made from two reliable sources, and both of them could find no mention made of such a condition. This was quite surprising to me for I feel that we are discussing a definite clinical entity; one about which there can be little, if any, doubt, and at this point I raise the question as to whether or not some of the hitherto unexplained deaths in gallbladder surgery may not have been due to this cause.

In the first place it is obligatory for me to show that the condition described was one of shock and not one of hemorrhage. That the condition was one of shock and not of hemorrhage was proved by the fact that no hemorrhage was present.

In the first place you will recall that these cases were all drained, and that following the removal of these drains there was not the slightest evidence of bleeding. So convinced were my associates and myself that bleeding might be behind the symptom complex, that the wounds were opened in two of these patients, in their beds, and not a particle of hemorrhage was found. The investigation was pushed in both of these cases to the point of certainty, and Dr. Bunch permits me to say that he resorted in one of his cases to the same method of settling whether or not hemorrhage were present with a negative result. Further than this the graphic charts will tell their own story of being a part of the symptom complex of shock. The symptomatology was one of typical traumatic shock; cold sweaty leaky skin, rapid pulse, 130 to 150, subnormal temperature, etc.

We also direct attention to the fact that these patients, all of them, had a perfectly normal postoperative convalescence, recovering completely from the operation and being in an entirely satisfactory condition up to the time of the removal of the gauze drains. The drains being removed on the sixth day. The con-

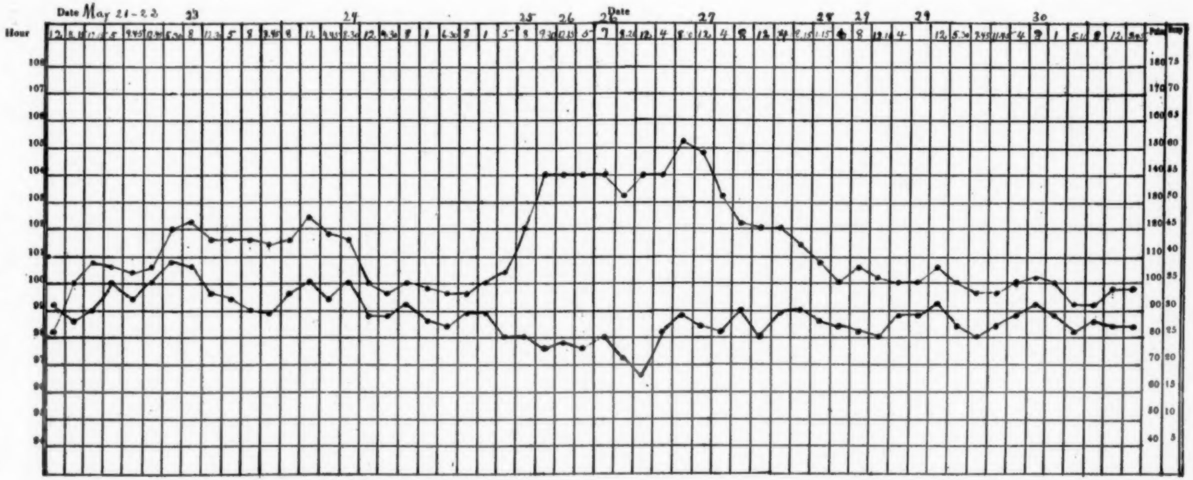


Fig. 364.—May 21st, 8.15 P. M.: Pulse, 100; temperature, 98⅜ F.
May 21st through May 25th, 1 P. M.: Drain removed.
May 25th to 27th: Pulse range of 150 to 154 following removal of drain. From this date on pulse range shows drop to normal convalescence. Notice low temperature during high pulse range.

dition does not reach its maximum intensity at once, but is fairly gradual in its onset; several hours elasping between the time of the removal of the drain and the maximum height of the pulse range.

It seems useless to give any detailed account of the clinical histories of these patients for the reason that they add nothing worthwhile to the discussion. Suffice it to say that they were all middle-aged men with a typical gallstone history, and all were in good physical condition, save the patient already mentioned above.

At this point it will be both interesting and helpful to quote from a personal communication from Dr. Crile which is done with his permission. Under date of November 6, 1928, Dr. Crile says: "Your letter of October 28th, has interested me greatly, for your experience with these cases has been so similar to ours under the same conditions and, in my opinion, your judgment as to the cause of these unfortunate sequelae which may follow the removal of the gauze drain is quite correct. The patients do die of shock—shock due to an impingement upon the sympathetic nervous system. It is only necessary to examine such illustrations of the innervation of the gallbladder and liver as are given in standard anatomies such as Cunningham and Gray and to study the distribution of the nerve supply to the gallbladder and liver in regard to its anatomic association with celiac plexus to see clearly how a slight trauma may have very far reaching results." It seems to me that this statement in conjunction with our findings well-nigh establishes the case.

Your special attention is directed to the fact that within the liver and gallbladder area is contained a great part of the sympathetic nervous system.

Another danger incident to the use of gauze pads in this region is the interference with the circulation in the low-pressure splanchic veins.

The operation of cholecystectomy in the hands of competent surgeons most of the time is conventional and simple: Quite often, however, the reverse is true. In the deeply placed, inaccessible, and densely adherent gallbladders, the operation of cholecystectomy can, at times, be most difficult. Occasionally in such cases one gets an amount of bleeding, or rather oozing of blood, which the gauze pressure readily controls. This is easy to understand when we recall that the blood pressure in the liver is very low and the best of us occasionally have a case in which it may be necessary to use gauze pressure to control the oozing.

We point to the additional fact that while these cases were accidental, they were in effect experimental.

So then we conclude that the condition was one of traumatic shock; shock to the sympathetic nervous system, due to the trauma incident upon pulling loose the gauze drain. We believe that the point is made perfectly clear by observing the picture of the innervation of the liver and gallbladder ducts from the illustrations in any of the standard anatomies.

What about prevention and how can we so act surgically as to avoid this serious complication? In the first place, as the years go by vastly better surgery of the gallbladder and ducts is being done; there is less trauma and much less necessity for drainage. In the second place, when in the occasional case the necessity for a gauze drain arises, we should place the gauze more into the fissure of the liver and never, unless forced to do so, place the gauze against the common duct.

So we would say, only drain when necessary. When gauze is used, keep it well protected with protective tissue and remember that the important point is not so much the using of gauze, as it is where we place it.

BULLET WOUND OF THE CAUDA EQUINA

Dr. Roger G. Doughty, Associate

A nineteen-year-old negro man was admitted to the hospital shortly after having been shot with a 38-caliber pistol. He was in moderate shock with a pulse rate of 140 per minute and a temperature of 98 F. The physical examination was in the main negative and the normal findings will not be enumerated. The wound of entrance was in the left side close to the posterior axillary line and two fingersbreadths above the end of the twelfth rib. There was practically no bleeding from the wound. It was thought that there was a small area of dulness at the base of the left lung in the neighborhood of the wound, though the breath sounds were not abnormal. The respiratory rate was 36 per minute.

There was a moderate general rigidity of the abdominal wall most marked in the extreme left lateral portion and the patient complained of considerable pain on palpation in this area. No shifting dulness could be made out and no mass was palpable. There was very slight distention. Over the area of the fourth lumbar process there was some tenderness on palpation, but this was not marked.

The negro complained that he was unable to move the left leg and examination showed complete anesthesia of the foot and up the posterior portion of the lower leg two thirds of the way to the popliteal space. He could rotate the whole leg slightly, but there was no sign of muscular contraction when he was asked to flex the knee or execute any movement with the foot or ankle. Movements of the right leg and foot were entirely normal. The ankle jerk and knee jerk on the left could not be obtained, but seemed normal on the right. The laboratory findings were in no way abnormal. *x*-Ray examination showed a fracture of the body and processes of the third lumbar vertebra with the bullet located within the spinal canal at this level.

Four hours after admission the spinous process of the third lumbar was removed (operator, Dr. R. G. Doughty) under ether

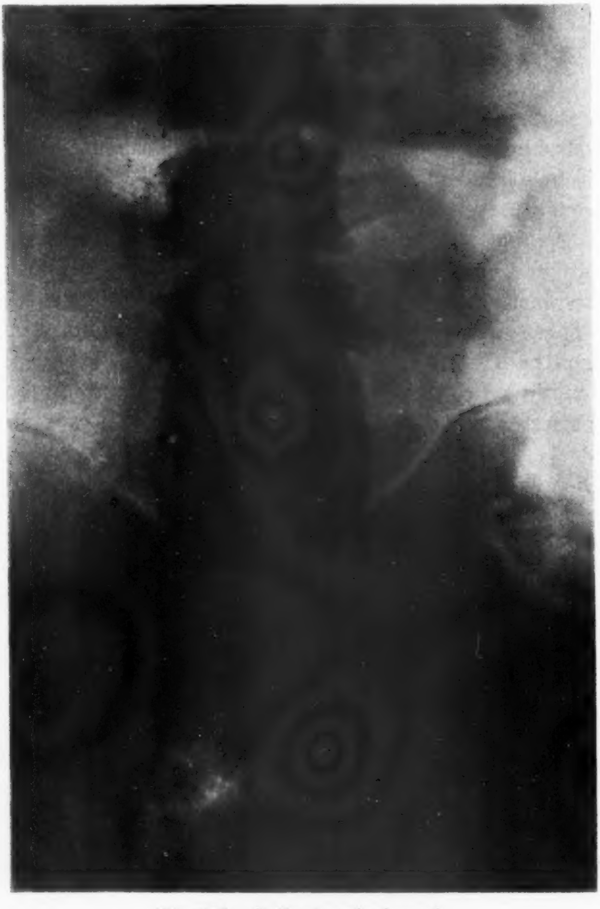


Fig. 365.—Bullet in spinal canal.

anesthesia and the bullet found within the dural sac, which it had severely lacerated, surrounded by tiny bits of bone. It was easily removed and the bits of bone were picked out. No severed nerves were found but during their inspection a brisk hemorrhage from the hole in the body of the vertebra began. It could only be controlled by a gauze pack. This had to be left in place, the end being brought out through a small stab wound in the skin flap. It was impossible to close the dura because of the extent to which it had been lacerated.

The immediate postoperative course was stormy. The temperature ranged around 102 to 103 F., the pulse around 140 per minute, and the respirations around 38 per minute. The abdomen became distended and the tenderness and rigidity in the left flank continued for so long that it was feared some intra-abdominal condition had been overlooked. A severe cough with production of at first a bloody and then a rusty thick mucus added to the patient's discomfort for several days. During this time both lungs were full of râles, but no real dulness could be made out.

On recovery from the anesthetic it was found that there was a complete paralysis of both legs without ,however, any marked extension of the anesthesia, though it was several days before adequate cooperation could be obtained in the sensory tests. It was never necessary to catheterize the patient, the bladder being normally emptied even from the first.

The gauze pack was removed from the wound on the sixth day. It inaugurated a most profuse flow of cerebrospinal fluid, six to twelve heavy dressings would be literally soaked during each twenty-four hours. This gradually lessened and ten days later the wound was healed. About the tenth day there appeared some voluntary movement of the right leg. This rapidly progressed to a full restoration in about a week. At the end of two weeks after the receipt of the injury some improvement in sensation was noted in the left lower leg. Anesthesia was present only over the dorsum of the foot and there was some hyperesthesia of the former anesthetic area on the calf. Voluntary contractions of the muscles of the leg were visible at this time, but were not sufficient to move the leg without assistance. No movement of the toes was present. By the twenty-first day practically all the muscles of the left leg were contracting, though still quite feebly.

The patient's general condition improved slowly. A cast was not applied at first because it was feared there might be some abdominal lesion as well as a spinal one. Later it could not be applied because of the profuse flow of spinal fluid so that no support could be afforded the injured weight-bearing bone until after the second week. Convalescence thence forward was uneventful. To date there has been about a 70 per cent restoration of the muscular activity of the left leg.

ANESTHESIA

Might I in conclusion give a very brief summary of the position of our clinic on the question of anesthesia?

Ether properly given by one thoroughly experienced in this type of anesthesia, with us is the anesthetic of choice. In our mild, even, and equable climate, ether anesthesia is really not a problem.

There are certain objections to this as well as to any other anesthetic agent, but for day in and day out use, in the average case, we know of nothing better nor of anything safer. I have often remarked that if we have no deaths save those attributable to ether as an anesthetic, we will be considered good enough as a surgical clinic. Our custom is to induce anesthesia by nitrous oxide and oxygen and to continue throughout the difficult part of the operation with ether given by the drop method.

This statement may be objected to by many surgeons, but it is our practice and we have no reason to change it.

The question of ether being responsible for the so-called "postoperative" pneumonia has been greatly overworked. The last 2 cases of postoperative pneumonia seen by myself were clearly septic in their origin and followed the local infiltration anesthesia in 2 cases of drainage of intraperitoneal abscess. Had these cases been given ether for the operation, they would certainly have been classed as ether pneumonia.

I am perfectly convinced after years of observation and experience, that the influence of climate on the choice of anesthesia has a marked effect.

Spinal anesthesia, in our opinion, has a definite and important place. In the first case of hepaticoduodenostomy reported in this clinic, spinal anesthesia was used. There was a definite reason for its use however, and it worked admirably; particularly as to the great degree of relaxation of the abdominal wall secured. This was a real contributing factor in the success of the operation. Spinal anesthesia has a marked field of usefulness in operations below the umbilicus. It is dangerous, we believe more dangerous than ether, and it is not free from the possibility of either temporary or permanent complications.

Nitrous oxide has its place, so also has ethylene, this anesthetic being the one of choice in many clinics. Local infiltration with novocaine is invaluable in many conditions. There are many others, all of which have their definite places in the field of anesthesia.

It seems to me that the whole question of the particular anesthetic agent used resolves itself into the judgment of the individual surgeon. One has to have many strings to his anesthesia bow, and the surgeon who has the capacity to hold each method of anesthesia within its normal and natural limitations, will secure the best results.

CLINIC OF DR. G. A. HENDON

LOUISVILLE CITY HOSPITAL

OPEN TREATMENT OF FRACTURES

Gentlemen: It is my purpose to present to you the subject of the Open Treatment of Fractures without describing the various methods that have been employed hitherto and which are familiar even to the most casual reader of surgical literature. I will describe a method that I have employed with remarkable success and rare satisfaction since January, 1920.

The method essentially consists of a plan by which the fragments of broken bones can be locked together in alignment and so retained without the use of external immobilizing apparatus. For the accomplishment of this purpose we use a device that we choose to call a Key, which securely locks the bones and retains them in approximation until the regeneration of bone is sufficiently advanced to restore their anatomical symmetry and their functional uses. The idea originated with a case of nonunion of the forearm upon which I operated twice by the orthodox methods failing in both instances. For the third attempt we used the method that I have been using since that time because of the rapid and perfect union that resulted. The advantages of this method are that it relieves the patient of the burden of apparatus, the long confinement in bed and the uncertainty of bone union and alignment.

To secure the contact of fragments we use a device that we choose to call a Key. It is made of the cortex of beef bone and can be obtained in convenient lengths and sizes. It is rectangular in its crossed diameters and varies in length up to 5 inches. It is made to taper toward one extremity very much similar to the steel shingle nail that was used in the preceding generation.

For example, one of these keys 4 inches long and $\frac{3}{8}$ inch in thickness at one end, tapers to $\frac{1}{8}$ inch at the other extremity. These are used in transverse fractures of the long bone and for fractures of the neck of the femur either transcervical or intertrochanteric. The Keys for oblique fracture are the same thickness throughout. We have used them in every form of fracture with marked succes—sincluding compound, gunshot, transverse, oblique, old, and new with equal success. In fact, there is no fracture of a disabling character or with displacement of the fragments in which it does not apply except pathologic fracture.

Taking for example a transverse fracture of the shaft of the femur at any portion of its continuity. A longitudinal incision is made along the outer aspect of the thigh through the skin and fascia. The muscles can be separated by a blunt dissection thereby avoiding hemorrhage. The fracture thus being exposed, the fragments are angulated to the surface by freeing the bone for some distance from the fracture of its muscular attachment. We have found it convenient when delivering the fragment to the surface to use a forcep which we call a clevis forcep. When the fragments are delivered one at a time, the ends, if jagged and uneven, are sawed to a smooth surface. We then take a bone Key, approximately 4 inches in length, and with a mallet drive it firmly into the medullary canal of one fragment leaving from $\frac{1}{2}$ to 1 inch projecting. The opposite fragment is delivered and sawed smooth and angulated outside the soft parts and buckled onto the projecting end of the Key. The wound is closed with through-and-through silkworm sutures, no catgut sutures or ligatures being used. The leg is then bound to a ham splint until the patient recovers from the anesthetic. He is then liberated and permitted to lie in bed in any position he desires. He usually prefers the one most favorable to the approximation of the fragments.

In case we have an oblique fracture a hole is bored at right angles to the long axis of the bone and the Key is driven through horizontally, allowing at least $\frac{1}{2}$ inch to project on each side, which prevents any tripping of the fragments over either end of the Key. The subsequent treatment is the same as that used for transverse fracture. The Keys that we use are made for me by Mr. Theodore Tafel, 319 Third Street, Louisville, Ky. They are kept on hand in assorted sizes and lengths and when needed are sterilized by boiling one half hour before using. We use the square shape because it fits more securely in a round hole; it does not pivot. For a hole $\frac{3}{8}$ inch in diameter we use a Key $\frac{3}{8}$ inch thick each way which gives it a $\frac{1}{2}$ inch distance on the diagonal, thus allowing a cut of $\frac{1}{16}$ inch on each of the four corners. This provides security and prevents pivoting.

In case of fracture of the surgical neck of the humerus, which is so frequent in old people, we expose the site of fracture, drive the Key firmly into the medullary canal of the humerus leaving 1 to $1\frac{1}{2}$ inch projecting, which can be readily forced into the cancellous structure of the detached head of the bone and contact is thereby obtained and secured. The only dressing required is a sling for the forearm.

Fracture of the hip forms our most interesting group, of which we have 31. Our patients ranging from fourteen to eighty-six years of age. There are only 2 under sixty-five—1 fourteen, 1 fifteen. In this group of cases we use a gas anesthetic, the patient is placed on the operating table with a sand bag beneath the gluteal region and a longitudinal incision made on the affected side which will expose the trochanter. A hole is bored through the cortex at the trochanteric base with a $\frac{1}{8}$ bit, $\frac{1}{4}$ inch in depth and a Key the proper length, which has been previously determined by measuring it against the *x*-ray film, is driven directly through the cancellous tissue of the neck until it engages the detached head. Care should be exercised in having the two limbs symmetrically posed before driving in the Key. Otherwise the position, if abnormal, will remain so. The wound is closed with through-and-through silkworm gut sutures carried down to the surface of the bone. The patient is then placed in bed and allowed to assume whatever position is most comfortable. If it is assured that no suppuration is likely to occur in the soft structure, the patients are allowed to sit up in bed or in a wheel chair if they desire. This usually occurs about the end of the third week and by the end of the fourth week they begin to walk on crutches with the aid of nurses. These patients recover without shortening in the broken leg. During the period of their confinement in bed they have the advantage of being moved as occasion requires for bathing and the use of the bed-pan and massage if necessary. The limb does not undergo atrophy that is so apparent in those that have been entombed in a sepulchre of plaster of paris for eight to twelve weeks.

Some very remarkable phenomena have been observed in the use of this plan of treatment for fractures involving any of the long bones. One of the most astonishing is the rarity with which suppuration or infections occur. Our experience has convinced us that a bone will resist infection with the same vigor and success that fascia does if it is not hampered by the embarrassment of capillary circulation in the adjacent soft parts. So far as infection is concerned there is no more danger in doing an open operation on fracture than there is in doing a radical cure for hernia. In the second place the rapidity with which bone regeneration takes place is quite remarkable. Union occurs in most cases in one half the time and in some cases one third of the time that is required when external immobilization is used. This we are convinced is also due to the fact that the source of nutrition which exists in the adjacent soft tissues being unimpaired by the weight of apparatus allows the unimpeded multiplication of bone cells necessary to a restoration of form and function. Third, muscular activity is quickly restored after recovery on account of the fact that atrophy of muscles, due to impaired trophic and vascular supply, has not prevailed. The question naturally arises as to what is the destiny of this bone Key that we use. Our experience is divided on that subject. We have cases in which the Key has disappeared, perhaps by absorption, after a lapse of six years. We have another in which it is still present after a lapse of six and a half years. At any rate it has never produced the reactions and insults in tissue that is associated with the prevalent idea of a foreign body. Being of the same structure as the bone there appears to be a homogenous gelation that entirely eliminates irritative consequences. While we do not believe that it ever becomes incorporated in the bone structure, yet we have unmistakable evidence that the bone cells grow in intimate contact and use it as a mechanical support during the process of regeneration. We have in one instance especially had occasion to reopen the wound after six months and found the Key which had been placed in the medullary canal of the shaft of the humerus firmly and solidily implanted. It goes to show that the bone structure instead of shrinking from the Key rather embraces it as a means of support.

Case I.—We have before us a child who was injured two and a half years ago by being struck by an automobile. The left tibia was crushed and the fibula broken and the tissues entirely torn from the anterior surface of the leg extending from the tuberosity of the tibia almost to the malleoli. We did not see the patient at that time, but she was placed in splints and a Lane plate was applied. At the present time there has been no reconstruction of either the soft or bony tissues. There is a suppurative mass of granulation tissue on the leg and the bone is still exposed as well as the Lane plates. The latter are loosely attached and the screws are about ready to drop out on account of the bone necrosis around each screw. What we did do is resect the ends of the fragments of the broken tibia until we reached healthy bone after first removing the Lane plates which was quite easily accomplished. After resection we found that we had a hand's breadth of space between the two fragments of the tibia. We introduced our bone Key which engages an inch above in the upper fragment and an inch below the lower fragment. In order to cover the exposed surface we lifted a flap from the calf of the opposite leg and by crossing the good leg over the injured and binding them in that position the flap draped very nicely across and covered the exposed raw surface. No splints or other external immobilizing apparatus was employed. After two years we find this girl able to walk without crutches or a cane and with the space between the fragments of the broken tibia entirely obliterated by the growth of bone. Union has not taken place but the two fragments are in contact. The patient walks with a slight limp. In the meantime she has undergone treatment for a syphilitic iritis that has almost destroyed her sight and she is now an inmate of the Kentucky School for the blind.

Case II.—We have a case in a man thirty years of age who one and a half years ago sustained a gunshot fracture of the right humerus about the position of the surgical neck which shattered the shaft and completely separated it from the head of the bone. This man was treated for one week in another hospital by the usual aeroplane splint. Under a general anesthetic we exposed the site of fracture and smoothed the jagged surfaces, introduced our bone Key into the medullary canal and buckled it into the soft cancellous tissue of the head of the bone. The wound was closed in the usual manner with through-and-through silkworm sutures. The patient was allowed to go without a sling because it was more comfortable for him in that position. He made a perfect recovery and ten weeks after the operation he was able to execute all movements of his arm that he had before he was injured. In other words, in ten weeks he had perfect restoration of function.

Case III.—We have a case in a man who was shot through the middle third of the humerus and the bone shattered. There were splinters of bone in the upper and lower fragment that were sufficiently attached to enable us to put our Key through a hole bored horizontally and retain the fragments in apposition without the use of a splint. This man made a perfect and complete recovery and is now engaged in his former occupation as coal miner in Harlan County, Kentucky.

Case IV.—A man shot through the middle of the thigh with considerable shattering of bone. This had occurred six weeks before he came under my observation in the Louisville City Hospital. Although he had been in plaster immobilization no effort of union had been established and there was considerable purulent discharge from the wound. The fracture was exposed and the ends of the fragments sawed smooth. The Key was driven into the medullary canal and the two fragments buckled

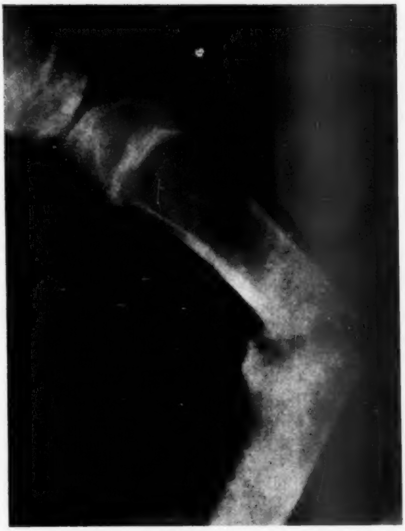


Fig. 366.—Nonunion fracture of femur, middle third, eighteen months, duration. Three open operations elsewhere failed.

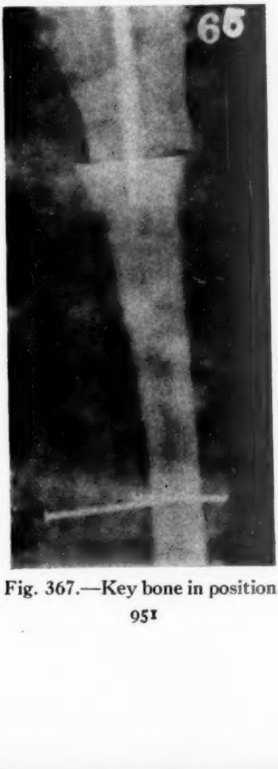


Fig. 367.—Key bone in position.

UNIV. OF MICH.

together. The wound was closed in the usual manner and within four weeks he was able to walk on crutches.

Case V.—A man was referred to me by Dr. Humphrey who sustained a compound comminuted fracture of the humerus in its lower third. An open operation was performed and the comminuted particles of bone removed and the end of the opposing fragments sawed smooth. When this was accomplished there remained a space of a little more than an inch between the surfaces of the two fragments. A Key was introduced, but we were not able to bring the bones any closer together than 1 inch. No splints were used, the man carried his arm in a sling. He did not suffer pain after the first three days and within twelve weeks union was complete, the space between the bones having been completely obliterated by regeneration of bone tissue. There is no interference with movement in the elbow joint and complete restoration of function has been obtained.

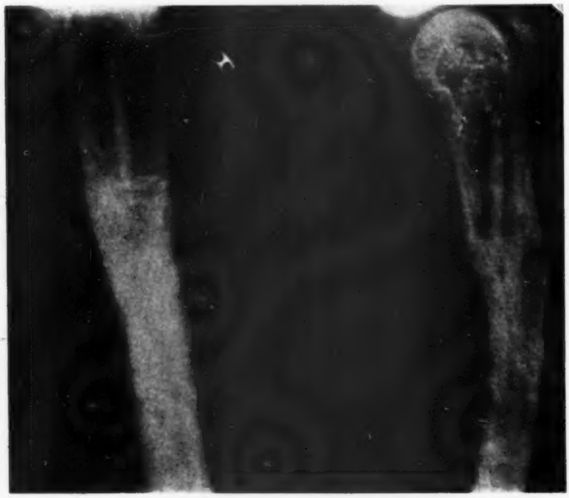


Fig. 368.—Condition three years after operation.

Case VI.—We have a case of compound fracture of the tibia with destruction of soft tissue about 2 inches wide and 3 inches long over the inner aspect of the lower and middle third. The fragments of bone were exposed over a corresponding area. The injury had been sustained six weeks before he came into our hands. Under an anesthetic the fragments were sawed smooth and buckled together with the Key. No splints or other external immobilization was used and union rapidly progressed, so did granulation. Until within a period of about eight weeks bony

Figs. 369, 370.—Final results.

union was complete and the granulating surface had healed over. This patient now walks without a perceptible limp. There is no shortening in his leg and the deformity due to the accident is hardly perceptible.

Case VII.—Mrs. T., now seventy-nine years old, sustained a fracture of the hip three years ago. The Key was inserted and within three weeks she was able to sit in a wheel chair and since that time has steadily advanced until she had a hemiplegic stroke about one year ago that affected the limb opposite to the injury. She now walks entirely on the injured leg due to the fact that the opposite leg is paralyzed. We have an *x*-ray picture recently made in Richmond, Virginia, showing perfect and complete union without any evidence of fracture having been sustained.

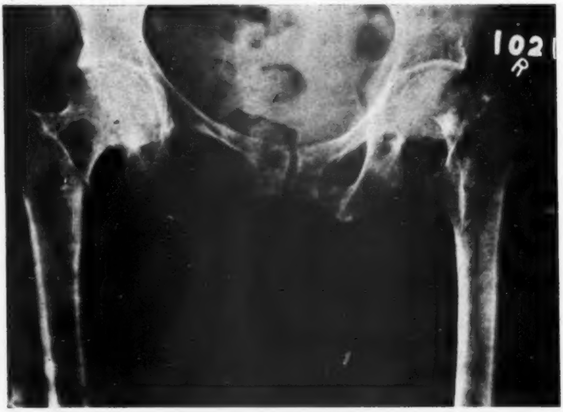


Fig. 371.—Fractured neck of right femur. Injury occurred twelve weeks previously. Patient confined to bed during that time. Aged sixty-nine.

Case VIII.—A patient who sustained a cervical fracture of her hip seven months ago in Hollywood, California. She was brought here as a hopeless case, it having been decided that union was impossible. Our Key was used by Dr. Kirk and myself.

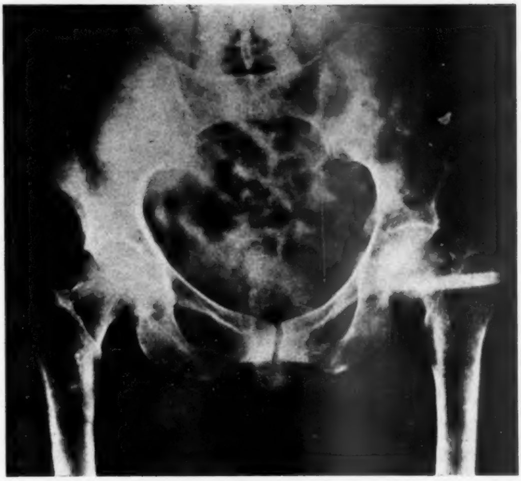


Fig. 372.—Shows Key bone in place. Patient was out of bed and on crutches in three weeks.

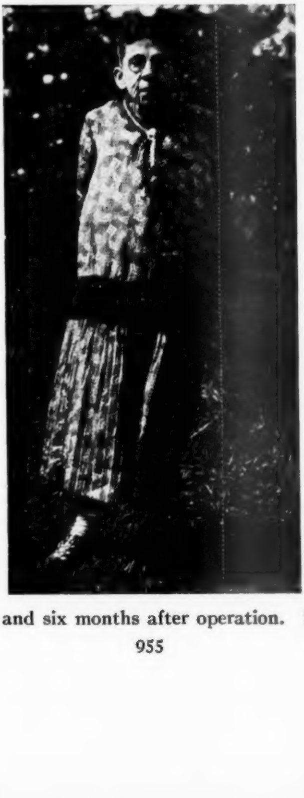


Fig. 373.—One year and six months after operation. She is fully restored.

union was prompt, she is now able to walk with a single crutch and but for concurrent infirmities the crutch would not be necessary.

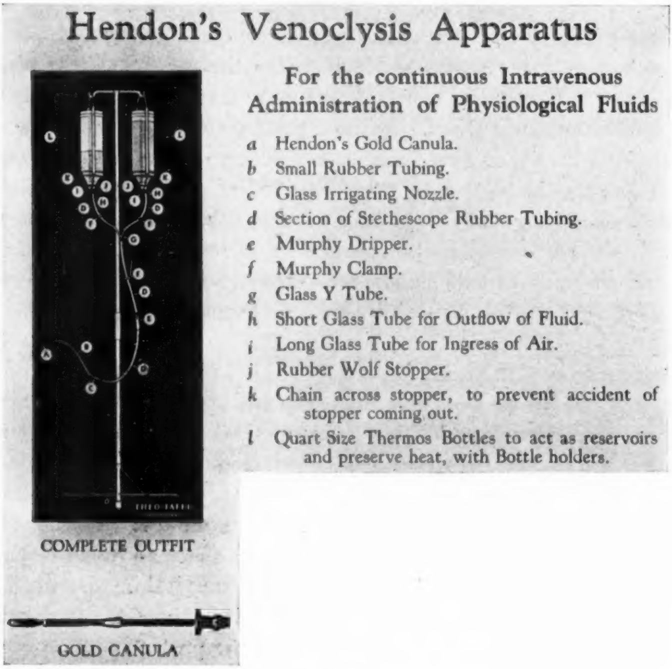
Case IX.—A city hospital case, aged sixty-eight, brought in suffering from delirium tremens. After one week of rather hectic experiences we inserted the Key and the third night after the operation he got out of bed in his delirium and walked about the ward on his crippled leg. This experience did not seem to interfere with his progress in the least. At the end of three weeks he left the hospital on crutches and was able to sit in a chair and cross his legs.

Experiences similar to these could be repeated until they would reach the stage of tiresome intolerance. I merely wish to present this group in support of my claim that fractures heal best when the adjacent soft tissues are least interfered with. Under those circumstances bone is no more liable to infection than fascia or any other body tissue and that the treatment of the future will be based upon this principle of direct approximation and retention.

VENOCLYSIS

GENTLEMEN: We have before us this morning a patient that was operated on a week ago for a suppurative appendicitis. Unavoidably and inevitably the peritoneum was soiled with the products of suppuration during the process of removal of the appendix. Previous to the operation, infectious material had found its way by infiltration through the surrounding peritoneal surfaces. The traumatism incident to the operation also rendered the tissues less resistant and more favorable to the attack of infectious organisms. Of those three counts a peritonitis was rapidly developed as a result of which segments of the intestine of indeterminable length were deprived of motile function and as a result adynamia ileus became established. In consequence this patient has been the victim of reversed peristalsis, dilated stomach, and distended abdomen, complete arrest of bowel movement, and excessive vomiting since he recovered from his anesthetic after the operation. His pulse has been going around 140, temperature 102 F. He has been unable to retain either food or water, nor has he been able to absorb any appreciable amount of fluid from proctoclysis. He shows marked evidence of extreme dehydration and the lack of food which results in a decomposition of fatty substances has caused a decided acidosis to become established. The problem that confronts us here is twofold and includes the supplying of fluid in the first place and food in the second place. I put fluid first because of its vital importance in the maintenance of cell life and because it is necessary to dilute the toxins to a degree that will enable the protective functions of the body to eliminate them through the natural emunctories and because toxemias that are diluted are less toxic than those that are concentrated. We are bound also to furnish food for reasons that are quite obvious to sustain the metabolism which supports the phenomena of life.

Our experience has taught us that patients in extremis are incapable of absorption of either food or fluid through the mucous membranes. That the alimentary tract could be filled with fluid in this man and not a drop would become absorbed because his mucous membrane has lost that important function through the action of disease. The same applies to food or nutrition. Therefore proctoclysis would be of no avail. The injection of fluids beneath the skin in the loose cellular tissues of the body have served in milder and more favorable cases, but sufficient quantity cannot be introduced in that way, neither can its administration be sustained for a sufficient length of time. Therefore, to meet these demands, we have employed a system which we have named venoclysis. This process has now passed the experimental stage having used by us in about 200 cases in an



Hendon's Venoclysis Apparatus

For the continuous Intravenous Administration of Physiological Fluids

a	Hendon's Gold Canula.
b	Small Rubber Tubing.
c	Glass Irrigating Nozzle.
d	Section of Stethescope Rubber Tubing.
e	Murphy Dripper.
f	Murphy Clamp.
g	Glass Y Tube.
h	Short Glass Tube for Outflow of Fluid.
i	Long Glass Tube for Ingress of Air.
j	Rubber Wolf Stopper.
k	Chain across stopper, to prevent accident of stopper coming out.
l	Quart Size Thermos Bottles to act as reservoirs and preserve heat, with Bottle holders.

COMPLETE OUTFIT

GOLD CANULA

Fig. 374.

experience extending over a period of five years. The process is employed as follows: We make a solution of dextrose which is our food ingredient in a sterile normal saline solution. This is poured into two thermos bottles, each holding a quart. These thermos bottles are provided with Wolf stoppers containing two holes, into one is inserted a glass tube reaching almost to the top

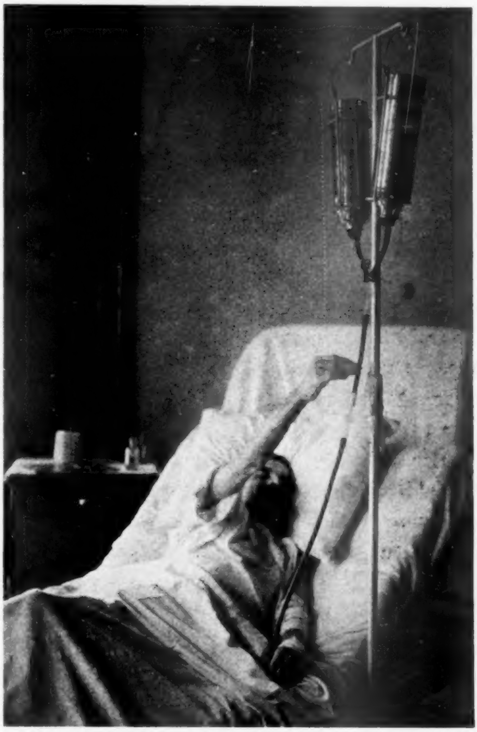


Fig. 375.—Venoclysis apparatus in operation. Patient regulating stop cock.

of the bottle, into the other a short glass tube reaching only through the rubber stopper. To this latter is attached a piece of rubber tubing of the thick wall variety which is known as stethoscopic tubing, to this is joined a visible Murphy dripper and a clamp with a screw adjustment above the dripper to regulate the flow. This is in turn attached to an irrigating nozzle. An illustration of the apparatus is shown herewith. The patients arm is constricted above the elbow and either the basilic or cephalic vein exposed by a short incision after having been anesthetized by an injection of novocaine. An aneurysm needle armed with a convenient length of umbilical tape is then carried beneath the vein and divided so as to provide two ligatures. The vein is then picked up with a mosquito forcep and the constriction released. Its distal extremity is tied with catgut. An opening is made immediately beneath the grasp of the mosquito forcep and our especially devised cannula is introduced into the vein. One piece of tape is now tied around the vein immediately behind the shoulder of the cannula and the other piece is tied in front of it and the cannula is connected by a short piece of rubber tubing to the irrigating nozzle, which establishes a communication with the source of supply. After the air has been allowed to escape, the screw adjustment on the clamp is opened to allow the fluid to enter at whatever rate may be desired. We find the most convenient rate is 500 cc. in two hours or 1000 in four hours or 5000 in twenty-four hours. A sterile dressing is applied over the incision and held with adhesive strips. The forearm is also encircled with adhesive strips at convenient intervals to hold the tube against the arm and prevents any pull upon the venous connection. The incision is closed with interrupted catgut sutures. No splints of the arm are necessary and reasonable freedom of the arm can be allowed. The fluid is placed in the thermos bottles, before they are suspended, at a temperature of 130. This allows it to reach the vein at a temperature of about 100. Any physiologic fluid can be administered in this way. We have used Ringer's solution, Fischer's solution, normal saline, dextrose in normal saline and in sterile water. The administration of physiologic fluids can be continued in this way for indefinite periods of time and almost any quantity desired can be administered. Chills very seldom occur because venoclysis can be made to sustain the normal ratio that naturally prevails between delivery and distribution. Our usual custom is to give these patients approximately 1 pound of dextrose per day which furnishes approximately 2000 calories which is sufficient food units to sustain life at moderate exercise. For a test record we have given 9 pounds of dextrose in five days and 11 pounds in six days without any discomfort to the patient. However, we regard these excessive quantities as entirely unnecessary and we endeavor to meet the requirements of the individual case. Experience has taught us that this will range between 200 and 500 Gm. per day and from 2000 to 5000 cc. of fluid. We have used this with remarkable success and the very highest degree of satisfaction in all conditions demanding vicarious sources of nutrition such as pernicious vomiting of pregnancy, meningitis, blood stream infections, peptic ulcer, and all forms of peritonitis. There is seldom a chill or elevation of temperature. There is almost invariably some swelling and redness of the arm above the site of introduction of the cannula. This subsides very quickly when the treatment is discontinued and when the treatment is persisted in it never becomes a serious complication. We have never observed any signs of embolism or thrombosis and the fluid entering as it does, about one or two drops to each cardiac pulsation, can under no circumstances produce any burden upon the heart that might tend toward a dilatation. Venoclysis renders the individual absolutely independent of his intestinal canal so far as nutrition and fluid are concerned. We fed one case of peptic ulcer in this way for sixteen days without oral alimentation except in the middle of the period when it was necessary to transfer the cannula to the opposite arm; a small amount of cereal was allowed to be taken by the patient.

Comment.—The patient presented at this clinic ceased to vomit immediately after the dextrose solution started to flow. It was kept going for sixty hours during which time he took 14,000 cc., 7000 cc. of 10 per cent and 7000 cc. of 5 per cent solution, or 10,050 Gm. of dextrose or $17\frac{1}{2}$ Gm. an hour. At the end of which time his nausea and vomiting had entirely ceased and he was able to satiate his thirst with water and take liquid fluid ad lib. In one week from the time the venoclysis was attached he left the hospital.